RAILROAD GAZETTE

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CONTENTS

ILLUSTRATED:
Atlantic Type Passenger Engines for the Chesapeake & Ohio 699
The Proper Curvature for a Filled Arch 700
Track in Tunnels 702
The Hart Tie Plate 704
The Acme Vestibule Diaphragm 705
The Cover Crank Pin Machine 709
Wear of Steel Tires in Germany 710
Weight of Steel in Bridges for Electric Railroads 711
CONTRIBUTIONS:
The Origin of the Elevated Railroads 697
EDITORIAL:
Locomotive Building in the United States 706
The President to the Railroad Firemen 706
Annual Reports: Southern Railway; Norfolk & Western; Canadian Pacific Ry.; Chicago Great Western; New York, Ontario & Western 706
Per Diem on the Southern 708
Editorial Notes 708
New Publications 708
Trade Catalogues 709
MISCELLANEOUS:
An Instructive Study of Specifications 697
A British Officer and American Railroads 698
President Roosevelt to Railroad Men 698
Board of Trade Control Over Railroads in Great Britain 701
Progress of the Lake Shore-Rock Island Chicago Terminal 702
The Master Blacksmiths' Convention 703
Proper Method of Counting Cars in Figuring Cost per Car at Terminals 703
The High Speed Brake 704
Modern Car Design and Construction 704
New Interlocking at Many Places 705
Passenger Elevators on the Central London Railway 705
Fog Signaling in England 709
GENERAL NEWS:
Technical 711
The Scrap Heap 712
Locomotive Building 713
Car Building 713
Bridge Building 713
Meetings and Announcements 714
Personal 714
Elections and Appointments 715
Railroad Construction 715
General Railroad News 715

Contributions

The Origin of the Elevated Railroads.

Dwight, Ill., Sept. 8, 1902.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I enclose herewith a communication made by me to the Chicago *Record-Herald* and published by that paper on the 6th of September.

In support of my statement I beg to refer you to the *Railroad Gazette* of Oct. 29, 1870; the *New York Observer*, Aug. 19, 1869; *Putnam's Magazine* for August and September, 1870, and many other papers about those dates in New York, Philadelphia, Chicago and other cities. The illustrations of my design were not satisfactory to me, but I found it impracticable to present the design in detail, and indeed I found no demand for it by capital, public opinion and professional choice being firmly fixed on some underground system, in the main following in the wake of the Metropolitan underground system of London.

The first era of rapid transit discussion in New York, extending from its inception to 1875, was almost exclusively given to underground, elevated and depressed roads through the blocks.

The Rapid Transit Commission of 1875 abandoned those plans and authorized the construction of elevated railroads on the lines of the streets, which prevailed and have been generally constructed in the great cities. Their amazing success has not been surpassed by any other system, and it remains to be seen whether it ever will be.

RICHARD PRICE MORGAN.

My attention has been called to an illustration and statement in *The Record-Herald* of Aug. 28 in respect to the original plan for elevated intramural rapid transit steam railroads. The article says: "General Sigel, in a word, was the father of the elevated railroad," and that "he suggested the idea in 1872." I would not take from the late General Sigel anything that properly belongs to his memory, because since the beginning of our great war, in which he took such a patriotic and valiant part, I have always respected him and would do him honor, but inasmuch as I am the author of the first report upon and plans for a double track elevated steam railroad over the center of the streets of New York or other large cities, I feel that I ought not to pass the error made by his friends without notice.

My plans were perfected in the winter of 1868 and 1869 at this place. The drawings, strain sheets and forms of material were so complete that a civil engineer skilled in iron bridge construction could from them estimate accurately the cost of the structure, its capacity for movement of trains, and construct the railroad.

In June, 1869, I published an illustrated descriptive report, and for distinctiveness entitled the structure the Gothic Arch Elevated City Railway. Five hundred copies of this report were distributed to the leading papers, magazines, civil engineers and others supposed to be interested in the subject.

These reports and illustrations called out in 1869 and 1870 many hundred thousand descriptive accounts and illustrations of my design. . . .

The result of the arduous labors of this distinguished commission [Rapid Transit Commission of 1874] and of the many eminent engineers who came before them with plans, and whom the commission consulted, was to set aside the plans for underground and depressed and elevated railroads through the blocks, on account of their great cost and other good reasons. Thus the field was won for those who advocated elevated roads on the lines of the streets, and the victory has been a complete one up to the present time. This commission authorized the construction of my design throughout all the streets on which they permitted any form of structure to be built. . . .

The reader who is fortunate enough to have access to a volume of the *Railroad Gazette* for 1870, will find in the issue of October 29 a very interesting account, with an engraving, of Mr. Morgan's gothic arch elevated street railroad. He proposed to span the street from curb to curb with a gothic arch, and within this gothic arch would be an elliptical arch supported by the main arch. The line of elliptical arches would carry the railroad structure, which would also be hung from the points of the gothic arches. The design might have been quite ornamental and the points of advantage which Mr. Morgan suggested are surely very obvious to those who have seen the development of the New York railroads, particularly within the last two years. He says it is the cheapest method that has been suggested, and that a most important consideration is the slight obstruction to the streets during the period of building. This consideration the citizens of New York will appreciate now more than they ever did before. Neither during its construction nor afterwards does the plan interfere with the gas, water, sewerage or pavements of the street. In the matter of light and ventilation it would be greatly superior to any underground road.

An Instructive Study of Specifications.

The relations of engineers and contractors, as defined and determined by specifications, has long been a fruitful source of discussion and, as time goes on and intelligence spreads, and more engineers become contractors, specifications gradually improve, and the relations become clearer and simpler. There are, however, some conspicuous examples of the unfortunate conditions of the older period, and within the last year or two we have heard many times of the burdens laid upon contractors by the specifications of the Bureau of Yards and Docks of the United States Navy, and further, by the arbitrary interpretation of those specifications. It will be profitable, doubtless, to engineers and contractors, to study somewhat carefully a specification recently issued by that Bureau for the building of a great masonry dry dock at Charleston, S. C., to cost something like a million dollars. A very few extracts from that specification are given below, with brief comment thereon.

Obviously a work of such importance should call for the best engineering ability in the preparation of the plans and specifications; the preliminary examinations and studies should be accurately made; the work to be done should be determined upon in advance and minutely described in all its details, both in the specifications and plans; and the specifications so drawn should be a masterpiece of engineering literature.

How far the engineer, however, has failed to realize these expectations is apparent in a reading of the specifications. The engineer acknowledges the inadequate performance of the work he was set to perform early in the specifications. After stating in paragraph (1) that "the declared and acknowledged intention and meaning is to provide and secure a completed and substantial dry dock," etc., "as shown, indicated, or called for by the accompanying plans and this specification, except as provided in paragraph 3," etc., he introduces paragraph (3) as below:

3. *Omissions and misdescriptions.*—The omission from the contract or from the plans, specifications, or other papers attached thereto and forming a part thereof of any work or material required to secure the result set forth in paragraph 1, or the misdescription of any details of work, the proper performance of which is necessary to carry out fully the intention above expressed, shall not operate to release the contractor from supplying all such materials and performing such work, but the same shall be fully and properly supplied and performed in the same manner as if fully and correctly shown, described and required in and by the contract, and without expense to the United States in addition to the contract price.

Here is indeed frank confession that the engineer does not exactly know what he wants, does not know how to describe the things that he wants done, and leaves it to the contractor to supply all deficiencies, correct all errors, and do all other things necessary for furnishing a "complete dry dock" at his own expense and without any additional expense to the Government; a shifting of responsibility unprecedented even in Government specifications.

The same idea is carried out in paragraph (25), from which we quote, calling particular attention to the last sentence:

25. *Checking plans and dimensions; lines and levels.*—The contractor shall check all plans furnished him immediately upon their receipt and promptly notify the civil engineer in charge of any discrepancies discovered therein, etc., but before laying out the work, and will be held responsible for any errors therein that thereby might have been avoided.

It will be noted that the plans referred to in the above paragraph are those furnished by the Bureau, but that responsibility for the errors is to be assumed by the contractor unless discovered by him in advance. Just why the contractor should be asked or expected to be responsible for errors committed by the engineer is difficult to understand. Undoubtedly errors may creep into the best prepared specifications, but when the rectification of these errors or discrepancies involves additional expense to the contractor, there should be provision made for reimbursing him for any expense to which he may be put thereby; but these specifications do not provide for this, and throw the whole onus on the contractor.

Another provision in the specifications is that by which, while the contractor is made responsible for the correct construction and completion of the work within the time specified in the contract and in accordance with the plans and specifications, yet the *control* of the work is placed in the hands of the government engineer.

5. *Control of work.*—The United States, by its Civil Engineer in charge of the work, or other authorized representative, shall at all times have full control and direction of all work under the contract, and all questions, disputes, differences os to any part or detail thereof shall be decided by such civil engineer or representative, subject only to appeal to the Chief of the Bureau of Yards & Docks.

Ordinarily, the engineer is given supervision of the work, and his powers and authority are limited. He can supervise the work and insist upon its being done according to the plans and specifications, and if he finds that the work is not being carried on in accordance with these plans and specifications, he may stop the work in question until the difficulty is adjusted; but he has, and should have, no power to step in and take immediate charge of the work, and this is a power which no reputable contractor will delegate to an engineer in charge of the work, either for the Government or for private parties. Under this clause, however, the civil engineer in charge has the right to take charge of all operations, handle the men and carry on the work as if it were his own. Possibly this was not the intention of the engineer in drawing up the paragraph, but it is within the experience of contractors who have done work for the Bureau that the engineer has attempted to do just such things. The real powers of the engineers are more reasonably defined in paragraph 26, where it is stated that the work "shall be carried out by the contractor under the inspection and supervision of an officer in charge." This clause does not, however, limit the powers given to the engineer by paragraph 5, above quoted.

Another provision in the specifications is given in the following paragraph:

15. *Progress of work.*—If at any time the progress of the work shall, in the opinion of the civil engineer in charge, appear to have been such as to indicate that the work is not likely to be completed within the time allowed, he shall report such opinion to the Chief of the Bureau of Yards & Docks, who may in his discretion, declare the contract null and void, without prejudice to the right of the United States to recover for defaults therein or violation thereof.

Under this paragraph a contract may be declared null and void if it should simply "*appear*" to the civil engineer in charge that the work is not "*likely*" to be completed within the time allowed, with provision that he shall report such "*opinion*" to the Chief of the Bureau, who may then at his discretion proceed to declare the contract null and void. But all reasonable men will agree that the cancellation of the contract should be based on a demonstration, and not on an impression.

The paragraph relating to changes in the plans and specifications reads as follows:

17. *Changes.*—The United States reserves the right to make such changes in the contract, plans and specifications as may be deemed necessary or advisable by the Chief of the Bureau of Yards & Docks. Should any such changes affect the cost of the work by a sum greater than $300, as estimated by the civil engineer in charge, the sum shall be ascertained by a Board of not less than three officers to be appointed under the direction of the Chief of the Bureau of Yards & Docks; and the contractor shall agree and consent that the contract price, increased or decreased by the sum so ascertained, shall, if approved by the Chief of the Bureau of Yards & Docks, be accepted in full satisfaction for all work done under the contract, etc. And provided further, that the increased or decreased cost shall be the estimated actual cost to the contractor at the time of such estimate plus a profit of 10 per centum.

The contractor is not represented on the Board and has no voice in determining the award, although he is sometimes—but not always, and only by courtesy—allowed a hearing. He has carefully calculated the cost of the original work, amounting to nearly a million dollars, and the price bid is the result of his personal judgment; but when a price is put on the additional work, perhaps amounting to 20 or 30 per cent. of the amount of the original contract, he is compelled to accept the judgment of a Board composed of men whose experience has not fitted them to form an accurate judgment in the matter. There is no recourse—he must accept the award or have the entire contract taken away.

In one paragraph of the specifications, the contractor is allowed a certain clear space at the site of the work, indicated on the plans, for the purpose of handling, storing and working material, and within which he is to confine his operations, and which he is presumed to have for his exclusive use; but in another paragraph the contractor is required to carry on his

operations in such a way as not to delay or hinder any work done by the Government, whether upon the site or not, and for any interference caused to the contractor by such operations of the Government "whether resulting in delay or additional expense, or not, no claim for extra compensation shall arise." That is to say, that the Government having set apart a certain site for the exclusive use of the contractor, may enter the said site, either by itself or by contractors working for it, and interfere with the operations of the contractor without redress to the contractor; and as a matter of fact, the Government has been known to enter upon the premises in just this way, letting contract for structures, for the safety of which the first contractor on the premises was held responsible so far as any change caused by his own operations was concerned.

It would be supposed that in a work of such importance as this, the Bureau would secure borings of such accuracy that the contractor would be safe in depending upon them in making up his estimate of the cost, and that he would not be expected to visit the site and make his own borings. The Bureau, however, after having made borings, waives all responsibility for their incorrectness, and puts upon the contractor the burden of "any additional cost of work due to any variation of the same that may be found during the progress of the work."

The Bureau, in lieu of making a complete examination in advance of the construction of the work, so as to be able to determine whether piles should or should not be necessary, decides to leave the determination of the point until the progress of the work has reached a certain point. It then provides for making certain tests to determine the bearing power of the material at the bottom of the dock, and also other tests to determine upon the necessity for driving piles. The making of these tests is postponed until the excavation is finished. It is well known among engineers as well as contractors, that in carrying on a large piece of work like that under consideration, where a large area is to be excavated to a great depth through water-bearing and perhaps treacherous soil, it is extremely ill-advised to complete the excavation over the entire area before proceeding with other parts of the work, such as pile driving or concreting. The well established custom, and the only safe one, is to excavate to the required depth only over such an area as can be readily managed and controlled. Then having driven piles or concreted this area so as to fix it and make it secure, another area is treated in the same way, and so until the work is completed. These specifications, however, provide that "after the excavation has been completed" (i.e., over the entire area) "the bearing power of the material at the bottom of the same shall be ascertained by tests made by the contractor at his own expense."

It will be noted that the tests are to be made by the contractor at his own expense. Another clause in the same paragraph limits the number of tests to five, and the area to be loaded to not less than 3 ft. sq. How much larger than this the area shall be, is left to the decision of the engineer in charge; and the work being done at the expense of the contractor leaves a fine field for the engineer to make as elaborate tests as he pleases, provided only that he limits them in number to five. This is one of the elements among many that the contractor must gamble on in estimating the cost of the work. If the Government would specify not only the number of tests to be made, but the area and the loading, and all the other elements going to make up the expense of making the tests, there could be no fault found with the cost being put on the contractor; but, if this should be impracticable, the tests should be made at the expense of the Government.

In addition to the above tests, the contractor is to drive four test piles of specified length and dimensions, and to weigh the piles with a load not to exceed 40 tons. In one part of the paragraph it is stated that the contractor shall do this work at his own expense, but in the final clause of the same paragraph it states that "if the tests show that piles will be necessary in the dry dock proper, any tests in connection with such test piles will be paid for by the Government, as resulting from a change in contract." It is difficult to get at the exact meaning of this clause, but evidently it involves a contradiction of the previous clause, which puts the expense upon the contractor. Just why the contractor should bear expense of the tests in case additional piles are not necessary, and not bear the expense in case they should be necessary is difficult to tell.

There are a number of items in the specifications for the material and workmanship which are not clearly defined as, for instance, the measurement of cement in mortar and concrete, but those we need not go into now.

In describing the method by which concrete shall be mixed, the use of machine mixed concrete is approved, provided that "should machines be used which do not have proper devices for delivering each of the different constituents to the mixer in the required proportions, the proper amount of cement, sand and stone required for a batch of not over 1 cu. yd. of concrete shall be measured out on the platform, and roughly mixed, so that when the dry mass is shoveled to the mixer, proper amounts of each of the ingredients will be taken up in each shovelful." Apparently this paragraph takes away much of the benefit of using a concrete mixer by insisting upon a considerable amount of labor upon the material before placing in the mixer, and would bar out the employment of the mixers of the best established reputations, if employed in the ordinary way. To fulfill these requirements would necessitate that the gravel should be carefully spread over a platform; then the sand uniformly spread on top of that and the cement as a third layer uniformly distributed over the other two; and that then the materials should be carefully shoveled by placing the shovel underneath the mass and throwing the material into the mouth of the mixer. This is contrary to all good practice, and an unnecessarily expensive way of doing concrete work.

Another paragraph requires that "concrete shall be tamped at the rate of not more than 72 ft. of concrete 9 in. thick per man per hour." The necessity for this clause is not obvious. The efficiency of the ramming is a function of the weight of the ram, the area of the ram, height of the fall, and the number of blows per minute; and to specify only the area that should be rammed within a certain time, without specifying the other items, will not bring about any definite results. While he was at it, the engineer should have specified the number of blows and the height of fall, which under another clause in the same paragraph are to be regulated by the civil engineer in charge, the weight of the rammer and the area of the base of the rammer being specified.

The specification for driving piles reads as follows: "The driving to proceed until the average penetraton per blow for the last five blows shall not exceed 1½ in. with a 3,000 lb. hammer falling freely 20 ft., or the equivalent, unless a modification is authorized." If there is anything that is as sure as fate, it is that a 3,000 lb. hammer falling freely on a pine pile with a drop of 20 ft. will smash the pile, whether shod or unshod, banded or not banded, and no one ought to know this better than the Department, whose specifications are under consideration; and yet this same old specification for driving is put in all their specifications, with the result that their piles are smashed and have to be drawn and replaced with other piles driven with a modified specification, which calls for about half the drop specified above.

Another curiosity provides that "the heads shall be cut off level at the exact elevation shown on plans, concave, convex or inclined heads will not be allowed, and when so cut off shall be recut in proper manner." It will be borne in mind that the piles are to be imbedded in the concrete without capping, and there is no reason for barring out such slight concavities or convexities in the head of a pile as might happen from sawing off the piles, or even slight inclinations in the cut-off.

Another instance of the shifting of the responsibility from the engineer to the contractor occurs in the case of the construction of the cofferdam, as also in the shoring up and protection of excavation and adjoining lands. While the design employed in the construction of the cofferdam and of the shoring and of other means for protecting excavations and adjacent lands must be furnished by the contractor, the engineer in charge reserves the right to insist on any modifications which may be considered necessary in order to meet his approval. That is to say, the contractor must design the cofferdam or the method of shoring which he thinks best suited for the purpose, and the engineer in charge may require him to adopt modifications that are not deemed wise by the contractor; and at the same time, the contractor is held responsible for the efficiency of such modified design, although it may not be, in his opinion, best suited to the purpose.

In an expensive piece of work done by the Government in which the cofferdam failed, it was claimed by the contractor that the failure was due to certain requirements which the Bureau engineer insisted upon in the construction of the cofferdam, and against the protests of the contractor. This statement we have on good authority, but cannot vouch for.

The foregoing are only a few of the many criticisms that might be brought against these specifications. They are sufficient to show how impossible it is for a careful contractor to make an accurate estimate of the cost of the work. Such faults deter contractors from bidding, and compels those who do bid to cover possible contingencies to such an extent as to make them high bidders. Usually the lowest bidder is the one who, while he may have counted upon doing a good piece of work, has underestimated the resources of the engineer, and finds himself hampered in his efforts to carry on his work to a speedy completion. The Government has had a wide experience in building dry docks, and should be able to write a definite specification. They have also had a valuable experience with contractors, which should lead them to make their requirements explicit. This would save the Government trouble during the execution of the work, and of expense later on.

While these criticisms are made to apply to a certain set of specifications, they might with certain variations be made to apply to many others which are faulty in the same way, though hardly to the same degree.

A British Officer and American Railroads.

Before this we have spoken of the visit of Colonel W. B. Constable, R. E., Manager of the Eastern Bengal State Railway, to the United States in 1901. His business was to examine and report on the workings of our railroads. His report is now published in *The Engineer* (London). He went over a good many roads and inspected their shops and rolling stock, as well as track. He also looked with care at the stations and the signals. Of course, his statements of facts are not of great interest to us, for he says what most of us know. Some of his opinions, however, are interesting.

Our practice of laying rails with broken joints is, he says, different from that of the rest of the world, and he assumes that we ought to know what we are about in that particular. Our use of from 2,500 to 3,350 cross ties per mile, as compared to 1,760 to 2,000 in India and England, gives a smoother and stronger track. In various matters about stations he thinks that Indian practice might well be modified towards ours. For instance, our platforms are much shorter and narrower, and, consequently, cheaper than in India. Again, Indian practice is too costly and severe in demanding over bridges at every small station. In the United States Colonel Constable discovers that we permit people to cross the tracks, and, at small stations, this may not be altogether wrong.

Our fencing, he thinks, is usually wretched in quality. Our roadbed is indifferent, but the tracks are strong because of the large number of cross ties, and the comfortable riding of our cars is due to their great length and weight.

The best station that Colonel Constable has ever seen is the South Terminal at Boston, which confirms the opinion that we long ago expressed that it is doubtless the best station in the world. "It possesses every convenience that can be thought of, and its decoration is not too ornate and extravagant."

Colonel Constable has no doubt that some kind of power interlocking (pneumatic or electric) will supersede the manual interlocking at all large stations, because of the reduction in the number of cabins and in the quantity of rods, pipes and wires, and in the space required and in the staff of operators. He is disposed to think that the electro-pneumatic system has some advantages over the entirely electric system and the purely pneumatic, but all of this he says is still a matter of opinion.

Colonel Constable was much impressed by the use of automatic block signals in the United States and "there is no doubt in my mind that English railroads will adopt some automatic system and by and bye perhaps, for suburban traffic near Calcutta, Bombay and Madras, it will have to be introduced into India."

On 40 miles of the New York Central, which he inspected, he found the best joints that he found in the United States. He was struck with the spring rail frogs, and had his inspection engine run over one several times, and he thinks that such frogs would be found useful in India. Slip switches, too, he thinks should be tried in India. "We are too much afraid of diamond crossings and slip switches in this country, whereas in America they are to be found everywhere, and are quite safe." The New York, New Haven & Hartford he found to be of the best Indian trunk line form, "but its fish plates are weak and the joints are down."

Colonel Constable was impressed with the American use of a heavy, tough, stiff rail of great tensile strength, with a broad top. He thinks that Mr. P. H. Dudley proves by figures that the cost of transportation, maintenance of way cost, and cost of renewals of rolling stock have all fallen with the use of stiffer rails. This is not that the heavy rails show less wear than the lighter ones—the contrary is the case. The saving is in less deformation of ties and in the better surface and smoother running with less waste of tractive effort. "These results agree with the opinions I have always held as to the ultimate economy to be obtained by using heavy rails, and I have never associated light permanent way with cheap lines. Light rails are always the dearest in the end, even for so-termed light railroads, for the lighter the permanent way the lighter the work below it can be."

President Roosevelt to Railroad Men.*

I have always admired greatly the railroad men of the country, and I do not see how any one who believes in the fundamental virtues of citizenship can fail to do so. . . . Railroad men are accustomed to enduring hardships, they are accustomed to irregular hours, they are accustomed to act on their own responsibility, on their own initiative, and yet they are accustomed to obeying orders quickly. The railroad man has to learn that when an order is issued there may be only a fraction of a second in which to obey it. He has to learn that orders are to be obeyed; and on the other hand, that there will come plenty of crises in which there will be no orders to be obeyed, and he will have to act for himself. Now, those are qualities that go to the very essence of good soldiership. When we were raising my regiment in a hurry and did not have time to teach a man he had to know how to handle a horse and to handle a rifle, to start with; but given the possession of those two qualities I found that there was no group of our citizens from whom better men could be drawn to do a soldier's work in a tight place, and at all times, than the railroad man. . . . In facing the problems of the twentieth century it must be a comfort to every well wisher of the nation to see what has been done by your organization. I believe emphatically in organized labor. Organization is one of the laws of our social and economic development. But we must always keep before our minds the fact that there is nothing sacred

*Extracts from an address before the Brotherhood of Locomotive Firemen at Chattanooga, Tenn., Sept. 8, by Theodore Roosevelt, President of the United States.

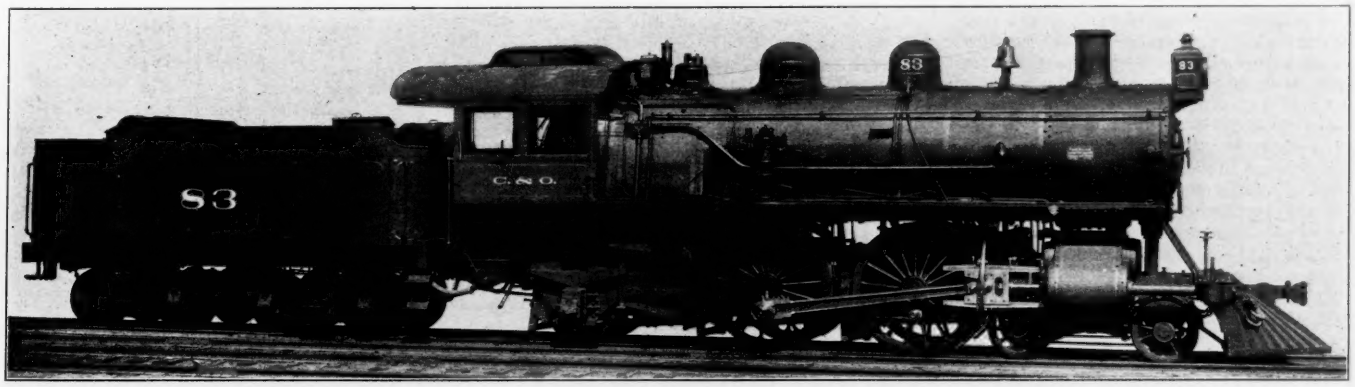
in the name itself. To call an organization an organization does not make it a good one. The worth of an organization depends upon its being handled with the courage, the skill, the wisdom, the spirit of fair dealing as between man and man, and the wise self-restraint which I am glad to be able to say your Brotherhood has shown.

. . . American citizenship can succeed permanently only upon the basis of standing shoulder to shoulder, working in association by organization, each working for all and yet remembering that we need each so to shape things that each man can develop to best advantage all the forces and powers at his command.

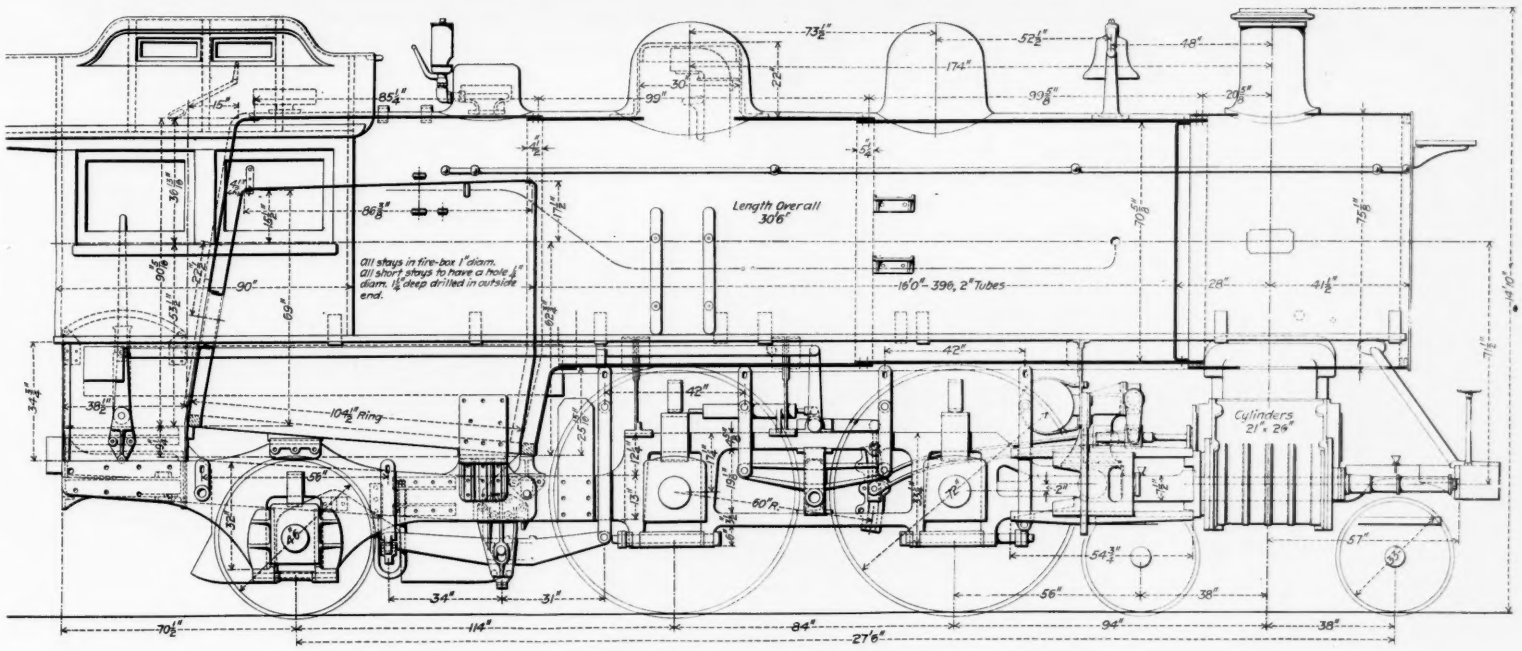
I want to see a good framework of labor organization; I want to see good laws on the statute books for all of us; I want to see our admirable constitution, whenever the need comes, rendered still more admirable, even if it is necessary to amend it. (Applause.) But, remembering the importance of all that, let us never forget that in the last resort the problem of good citizenship is the problem of producing good men and women. That is the fundamental problem. All the organizations in the world, the best development of the brotherhood, will not make a coward or a shirk a good engineer or a good fireman, and the best law, the best constitution will work only ill if we have not in the average citizen that which counts for more than intellect and stands far above intellect, as intellect stands above mere brute strength—character; character that is composed of three elements, of honesty, of courage and of hard common sense.

Weight on drivers	93,000 lbs.
Weight, total	173,000 lbs
General Dimensions.	
Wheel base, total, of engine	27 ft. 6 in.
Wheel base, driving	7 ft. 0 in.
Height of stack above rails	14 ft. 10 in.
Heating surface, fire-box	181 sq. ft.
Heating surface, tubes	3,298 sq. ft.
Heating surface, water tubes	27 sq. ft.
Heating surface, total	3,506 sq. ft.
Grate area	50 sq. ft.
Wheels and Journals.	
Drivers, diameter	72 in.
Drivers, material of centers	Cast steel
Truck wheels, diameter	33 in.
Journals, driving axle, size	9½ x 12 in.
Journals, truck axle, size	6 x 12 in.
Cylinders.	
Cylinders, diameter	21 in.
Piston, stroke	26 in.
Piston rod, diameter	3½ in.
Valves.	
Valves, kind of	Piston
Valves, greatest travel	6 in.
Valves, outside lap	1 in.
Valves, inside lap	⅛ in.
Valves, lead in full gear	0 in.

Boiler.	
Boiler, type of	Straight top
Boiler, working steam pressure	200 lbs.
Boiler, material in barrel	Steel
Boiler, thickness of material in barrel	½, ⅝, ¾, 1 in.
Boiler, diameter of barrel	72 in.
Seams, kind of horizontal	Butt joint, sextuple riveted
Seams, kind of circumferential	Double riveted
Thickness of tube sheets	½ in.
Crown sheet stayed with	Radial stays
Fire-box.	
Fire-box, length	96 in.
Fire-box, width	75 in.
Fire-box, thickness of sheets	5/16 in., ⅜ in.
Fire-box, water space, width	Front, 4 and 5 in.; Sides, 3½ and 5½ in.; back, 3½ and 4½ in.
Grate, kind of	Rocking
Tubes.	
Tubes, number	396
Tubes, material	Charcoal iron
Tubes, outside diameter	2 in.
Tubes, length over sheets	16 ft. 0 in.
Other Parts.	
Exhaust nozzle, single or double	Single
Exhaust nozzle, diameter	5¼ in., 5½ in., 5¾ in.
Stack, diameter	18 in.
Tender.	
Tank capacity for water	6,000 gal.
Coal capacity	9 tons
Type of underframe, wood or iron	10 in. steel channels
Type of truck	4-wheel center bearing with channel bolsters
Diameter of truck wheels	36 in.



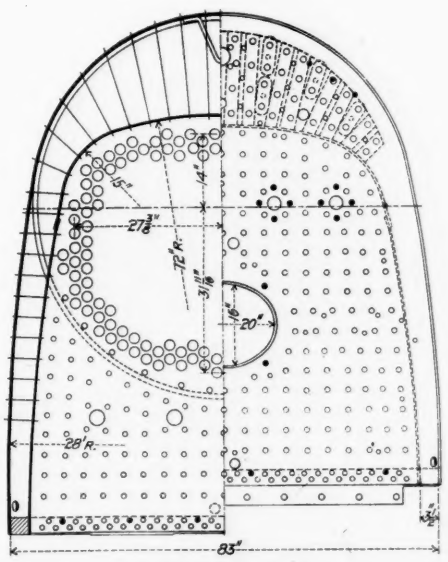
Chesapeake & Ohio Atlantic Type Passenger Engine.



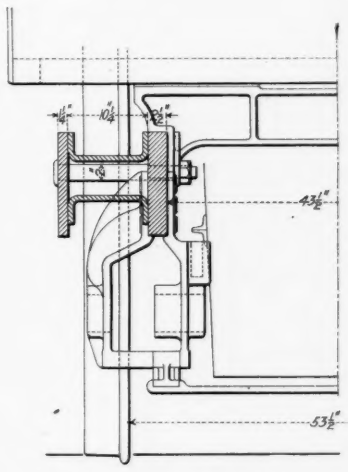
General Elevation—C. & O. Atlantic Type.

In our issue of Aug. 1, 1902, was described and illustrated a 4-6-2 engine for the Chesapeake & Ohio, intended for heavy passenger service over the mountains. An excellent second for this engine recently turned out by the Schenectady works of the American Locomotive Company for the same road is shown in the accompanying engravings. The engine here shown has practically the same heating surface as the 4-6-2 type and the same diameter of drivers. The boiler is of the straight top type with wide fire-box, and the engine is equipped with a traction increaser similar to that on the New York Central Class I Central-Atlantic engines. The general dimensions are given below:

Kind of fuel	Bituminous



End Elevation of Boiler.



Section Through Ash-pan.

C. & O. Atlantic Type.

The Proper Curvature for a Filled Arch.

BY DANIEL B. LUTEN.

For economy and efficiency of materials in an arch structure, the center line of the arch ring should coincide very approximately with the curve of equilibrium of the given loading. This principle has been very generally violated by designers of stone and concrete arches loaded with earth filling limited by the horizontal plane of the roadway above. The segment of a circle commonly used in such cases cannot even be considered an approximation to the true curve of equilibrium, which is the transformed catenary. An oft-cited case of the difficulties into which the use of the segmental rib may lead the designer, is the sandstone arch at Wheeling, W. Va., in which the loading of earth-filling over the haunches was lightened by substituting empty chambers between the spandrel walls. The construction of such chambers is not only more expensive than the filling of earth, but it also results in deflecting the thrust upwards from the position it would otherwise have had, thus in general requiring more massive abutments to resist it.

A better tendency is shown in the design of several large concrete-steel arches that have been erected in the past few years, notably the bridges at Topeka, Kan.; Newark, N. J.; Niagara Falls, N. Y., and Zanesville, Ohio, all of which show the curvature of the arches increasing toward the abutments. This point, moreover, is of æsthetic value; for it shows, or will show when the layman becomes educated on this point, that the arch with curvature increasing towards the abutment is an arch supporting a filled roadway, while that with curvature constant, or decreasing, supports a skeleton superstructure.

The difference in curvature between the segment of a circle and the true curve of equilibrium for a given loading, may be shown by a comparison of their radii of curvature. The effect of the live load upon the curve of equilibrium of a masonry arch, is very slight as compared with the weight of earth fill, and should be provided for by increased thickness of rib, while the curvature of the rib is made to fit the conditions of dead loading. If the earth filling be bounded by a straight line, or a transformed catenary above, and it be assumed that the earth pressure is everywhere vertical, then the curve of equilibrium of an arch to support that filling is the transformed catenary. This requires also that the earth filling shall be of uniform density throughout, or else that layers of different densities must be bounded by transformed catenaries derived from the same original catenary as the curve of equilibrium. Evidently it is not a fair assumption to suppose that the earth pressures shall be vertical, but as any horizontal components will only increase the required curvature of the arch near the abutments, the transformed catenary is the nearest approach to the segment of a circle that the curve of equilibrium possibly can have; and as the horizontal components cannot be determined, although there is no doubt that they do exist, it is safer in this comparison to deal with this limiting case.

The transformed catenary is a curve derived from the

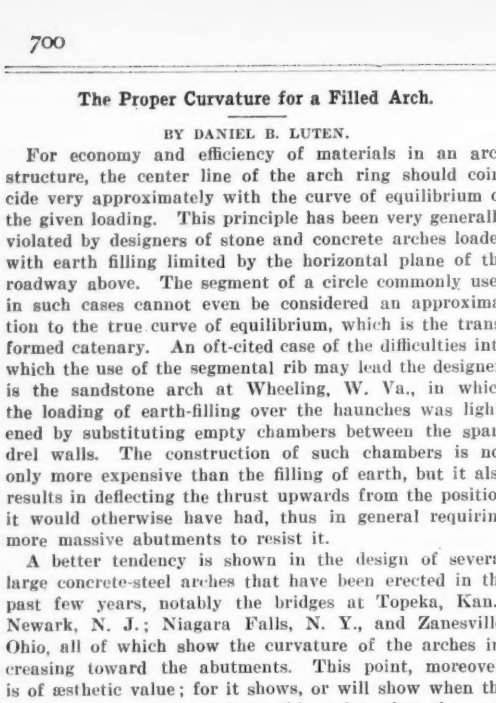


Fig. 1.—Radii of Curvature of Transformed Catenary.

catenary by vertical projection; that is, by increasing or decreasing each of the ordinates from the catenary to the directrix in the same proportion. The equation of the catenary referred to its directrix as axis, is $y = \frac{a}{2}\left(e^{\frac{x}{a}} + e^{-\frac{x}{a}}\right)$ where a is the least ordinate, or the parameter of the catenary, and e is the base of the Naperian logarithms, that is, 2.71828. The equation of the transformed catenary is then $y = \frac{y_0}{2}\left(e^{\frac{x}{a}} + e^{-\frac{x}{a}}\right)$ or expressed in hyperbolic functions, $y = y_0 \cosh \frac{x}{a}$, where y_0 is the least ordinate to the transformed catenary.

The radius of curvature of any curve is given by the following formula, $R = \frac{\left[1 + \left(\frac{dy}{dx}\right)^2\right]^{3/2}}{\frac{d^2y}{dx^2}}$. For the transformed catenary, $y = y_0 \cosh \frac{x}{a}$, $\frac{dy}{dx} = -\frac{y_0}{a} \sinh \frac{x}{a}$, and $\frac{d^2y}{dx^2} = -\frac{y_0}{a^2} \cosh \frac{x}{a}$.

Substituting these values and neglecting the minus sign, we have $R = \frac{\left(1 + \frac{y_0^2}{a^2} \sinh^2 \frac{x}{a}\right)^{3/2}}{\frac{y_0}{a^2} \cosh \frac{x}{a}}$, or $\frac{R}{a} = \frac{\left[1 + \left(\frac{y_0}{a}\right)^2 \sinh^2 \frac{x}{a}\right]^{3/2}}{\frac{y_0}{a} \cosh \frac{x}{a}}$. With the aid of a table of hyperbolic sines and cosines this function is easily solved for particular values of the variables. Assuming definite values for y_0/a the values of R/a may be plotted as ordinates, and those of x/a as abscissae, resulting in the curves shown in Fig. 1. From this diagram the radius of curvature can be determined when the value of y_0/a is known. Y_0 is the least ordinate of the transformed catenary, that is, the vertical distance of the center line of the rib at the crown, below the surface of the roadway. a is the parameter of the catenary from which the transformed catenary is derived, and depends upon the span, rise, and depth of filling at the crown. Its value may be determined from the equation,

$$a = \frac{x_1}{\text{hyp. log.}\left[\frac{y_1}{y_0} + \sqrt{\left(\frac{y_1}{y_0}\right)^2 - 1}\right]}$$

where x_1 is the abscissa of any point through which the transformed catenary is desired to pass, and y_1 is the ordinate of the same point, while y_0 is the least ordinate. If, as is usually the case, the given point x_1 y_1 is the springing point of the center line of the arch rib, then x_1 equals the half-span, and y_1 equals the depth of filling over the springing point Y_0/a is given directly by the equation, $y_0/a = \frac{y_0}{x_1}$ hyp. log. $\left[\frac{y_1}{y_0} + \sqrt{\left(\frac{y_1}{y_0}\right)^2 - 1}\right]$

The solution of this equation requires the use of hyperbolic logarithms, as will be shown later in the solution of a special case.

Suppose it be desired to examine the curvature of a transformed catenary of 100 ft. span, 10 ft. rise, and depth of loading at the crown of 3 ft. X_1 then equals 50, y_1 is 13, and y_0 is 3. $Y_0/a = 3/50$ hyp. log. 8.549. To determine the hyperbolic logarithms of numbers the following table will be found convenient. The hyperbolic logarithm of any number is found by adding together the values in this table corresponding to the figures of the common logarithm of the number.

1.0	2.302585
2.0	4.605170
3.0	6.907755
4.0	9.210340
5.0	11.512925
6.0	13.815510
7.0	16.118096
8.0	18.420681
9.0	20.723266
10.0	23.025851

The common logarithm of 8.549 is found from a table of logarithms to be 0.93191; the addition follows:

0.0	0.0
.9	2.0723266
.3	690775
.1	23026
.9	20723
.1	230
	2.1458020

The hyperbolic logarithm of 8.549 is 2.146, which substituted in the above equation gives $y_0/a = {}^3/_{50} \times 2.146 = 0.128$.

Referring now to the diagram of Fig. 1, the curve corresponding most nearly to this value of $Y_0/a = 0.128$ is that for $Y_0/a = 0.125$; if the curvature be desired with accuracy, the values may be found by interpolation between the curves $y_0/a = 0.125$ and $y_0/a = 0.150$. Since $y_0 = 3$, the value of a is given by ${}^3/a = 0.128$, or a is equal to 23.44. At the point of springing then, where x is 50, the abscissa on the diagram, x/a would be 2.1, the ordinate to the curve $y_0/a = 0.128$, corresponding to this value 2.1 of the abscissa, is 2.70, which is the radius of curvature divided by a, R/a. The radius of curvature then at the springing is 63.3 ft.

The radius of curvature at the crown where x/a equals O, is R = 7.9 a = 185 ft. The radii at points at intervals of 10 ft. horizontally, for this particular curve, are:

Crown, x = 0, r = 185. ft.
x = 10, r = 171.0 ft.
x = 20, r = 139.5 ft.
x = 30, r = 98.5 ft.
x = 40, r = 80. ft.
x = 50, r = 63. ft.

The curve may now be drawn as in Fig. 2, by drawing an arc of a circle across each 10 ft. interval, with a radius the mean of the two adjoining radii or curvature. Thus $R_1 = 178$ ft. $R_2 = 155$ ft., $R_3 = 119$ ft., $R_4 = 90$ ft., and $R_5 = 71$ ft.

The segment of a circle shown in the same figure, which has the same span of 100 ft. and rise of 10 ft., has a radius of 130 ft., which is very nearly a mean between the radii of curvature at crown and springing of the transformed catenary. These two extreme radii vary by nearly 50 per cent. from the constant radius of the segmental circular curve. To determine the variation of the two curves measured on the vertical ordinate, the ordinates measured from the directrix for each curve are evaluated for intervals of 10 ft. The difference between the ordinates to the two curves for the same value of x will be the vertical deviation. The equation of the transformed catenary is $y = 3 \cosh \frac{x}{23.44}$, and of the circle referred to the same origin, is $x^2 + (y - 133)^2 = 130^2$. The difference between the vertical ordinates is $133 - \sqrt{130^2 - x^2} - 3 \cosh \frac{x}{3.424^x}$. The values of this expression for specific values of x are:

x = 10, y — y¹ = 1.5 in.
x = 20, y — y¹ = 4.5 in.
x = 30, y — y¹ = 8.5 in.
x = 40, y — y¹ = 9.5 in.

In other words, if the span were built as a segment of a circle, the center line would lie wholly within the true curve of equilibrium, touching it only at crown and springings, and passing 9½ in. below its position at the haunches. For the given span of 100 ft. this would result in an increase of the dead loading of 6 per cent.; it would also mean that one and one-half cu. yds. of masonry for each foot of width of arch ring, which should have been placed on the outside of the rib to insure uniform distribution of stress, would be placed instead on the inside of the rib, producing eccentric loading; and, worse still, the 6 per cent. additional load is placed at the point, where the rib is most weakened by the eccentric arrangement of material. The deviation as above determined is, moreover, the minimum value; if the segment of the circle were outside the curve of equilibrium, then it would serve as a factor of safety against the horizontal pressures of the earth filling; but the deviation is entirely on the danger side. It is no wonder, therefore, that the segmental arch rib requires an extravagantly heavy section in order to withstand this tendency to failure by settlement at the haunches.

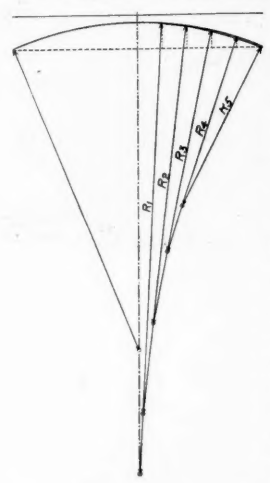


Fig. 2.—Method of Drawing Curve for Arch.

The substitution of the segmental for the catenarian rib results in the thrust against the abutment being more nearly horizontal than would be the case in the latter curve were employed, necessitating consequently heavier abutments, except where the thrust is resisted by a rock ledge. It has been observed, so it is said, that most failures of arches have been by settlement at the crown; and this has been urged as an argument for greater curvature at the crown, whereas the conclusion here is, that less curvature at the crown and more at the haunches would be an improvement in segmental arches. It is to be noted, however, that slight yielding of the abutments would affect the crown more unfavorably than other points, and might account for the failures referred to.

When the horizontal thrust of the earth filling is taken into consideration, the resulting curve of equilibrium is

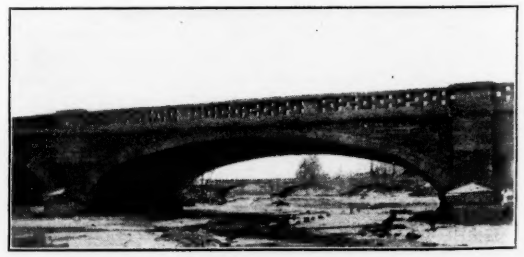


Fig. 3.—Concrete-Steel Arch at Indianapolis, Ind.

so sharply curved at the haunches that it is easily modified into the basket handle type of arch with a distinct gain in appearance over the segmental rib.

The above analysis was made for a proportion of rise to span of ${}^1/_{10}$ because that represents very nearly the extreme of practice; very few arches have been built with a less rise than ${}^1/_{10}$ of the span. As the proportion of rise to span increases, the deviation of the segment of a circle of the same span and rise, from the transformed catenary, increases, as the following values for a curve of span 100 ft., rise 30 ft., and depth at crown of 3 ft., will show. $Y_0/a = 0.185$, and a = 16.22; the radii of curvature for values of x are:

x = 0, R = 87.5 ft. y — y¹ = 0. in.
x = 10, R = 76.0 ft. y — y¹ = 3.5 in.
x = 20, R = 51.8 ft. y — y¹ = 13.0 in.
x = 30, R = 38.9 ft. y — y¹ = 21.0 in.
x = 40, R = 48.6 ft. y — y¹ = 22.0 in.
x = 50, R = 113.4 ft. y — y¹ = 0. in.

The radius of curvature decreases from 87.5 ft. at

the crown to 39 ft. at a point 20 ft. from the abutment, then increases to 113 ft. at the springing. The radius of the circle having a segment of 30 ft. rise in 100 ft. span, is 56.7 ft. The vertical deviation from the catenarian rib is 22 in. at a point 10 ft. from the abutment.

For the value of $y_o/a = 1.0$, the transformed catenary becomes coincident with the catenary, and the curve for that value, shown on the diagram, has ordinates proportional to the radii of curvature of the catenary. Thus the catenary having $y_o = a = 3$ ft., has the following radii of curvature, taken at horizontal intervals of one foot.

$x = 0.0$ ft., R = 3.0 ft.
$x = 1.0$ ft., R = 3.3 ft.
$x = 2.0$ ft., R = 4.5 ft.
$x = 3.0$ ft., R = 7.2 ft.
$x = 4.0$ ft., R = 12.0 ft.
$x = 5.0$ ft., R = 19.2 ft.
$x = 6.0$ ft., R = 35.0 ft.

Generally speaking the catenary cannot be used for an arch rib, since it is determined by three conditions.

In the transformed catenary, for certain proportions of span, rise and fill at crown, the point of maximum curvature will not be at the springing, but will be found intermediate between the crown and springing as in the second example above; such a curve would be unsightly in an arch. But when the horizontal pressures of the earth filling are taken into account this point of maximum curvature will be moved to the springing, as is desirable for the sake of appearance.

Fig. 3 is a view of the segmental circular stone arch highway bridge on Illinois street in the City of Indianapolis, with the three spans of the Meridian street bridge showing in the background; the two latter bridges are of concrete-steel and their curves are three centered, approximating the catenarian curve advocated in this article.

Board of Trade Control Over Railroads in Great Britain.

BY H. RAYNAR WILSON.

(Concluded from Last Issue.)

It will be noticed that there are no regulations as to automatic signaling. The reason for this is that when these regulations were issued the principle had not been introduced into Great Britain, and since then so little progress has been made that no standard regulations have yet been placed on record, those companies who have such signals having drafted their own proposals, which have been submitted for confirmation. It is, however, anticipated that the use of automatic signals will be considerably extended and probably then standard requirements will be issued by the Board of Trade.

Certain requirements quoted may appear strange to some American readers. There is the reference at the commencement of the requirements to dispensing with signals on single lines. It must be remembered that in the United Kingdom practically all points and signals are now interlocked and no points on, or leading to, passenger lines are worked except from an interlocked signal tower or ground frame and protected by fixed signals. But outlying sidings on single lines are worked from a small ground frame, the levers of which are unlocked by the train staff or tablet. When the levers are unlocked and in use the staff or tablet is "backlocked" in the frame so that it cannot be withdrawn until the levers have been restored. Thus the points must be left set for the main line except when the staff or tablet is present.

The arms of signals at junctions must be arranged so that the top arm applies to the line leading to the left; but where the high speed route is not to the left, then a separate signal post or doll has to be provided for that arm. The placing of one arm above another is most rare now in British signaling. Neither is it the practice to blind any of the lights of low-speed signals. The only lights that are obscured are those of what are known as "calling-on arms," used as substitutes for hand signaling. Such signals have their lights blinded when at danger, and a small green light appears when the arm is pulled off.

It is stated that disk signals are preferred for siding signals. It should be noticed that in this dwarf signals are regarded as disk signals, although the Lancashire & Yorkshire, of which the writer was the Signal Engineer, is the only line where dwarf signals are the standard siding signal. There they were introduced by Mr. Henry Johnson.

It will be noticed that white front lights are not sanctioned, red being used for danger and green for all-right. There is never any cautionary signal at the home signal post. All lines are worked on the absolute block system and there is, therefore, no need to make any distinction between caution and all-right. Where it is necessary to warn an engineer that he must approach the next tower with care, the towerman keeps his signals at danger and pulls the engineer up and warns him verbally, showing at the same time a green flag by day, and a green light by night.

As disk signals are now becoming general for switching operations from one line to another and from the main line to side tracks the number of red lights has considerably multiplied, and engineers find the constant appearance of red lights a nuisance. On two British railroads this has been met by making the front lights of the disk signals to be a small white one—white being now a danger signal.

Whilst the Board of Trade limit the use of facing points to 200 yds., they are prepared to extend the limit to 300 yds. where power systems are in use, always provided that the view from the tower is good.

In the paragraph in which it is laid down that facing points are to be provided with facing point locks and detector bars it is stated that means are to be provided for detecting any failure between the signal tower and the points. This is done by the use of what are known in England as "detectors" (the British term for detector bars being "locking bars"). These are attached to the switches of the facing points; and the wires of the signals for leading over the points are threaded through the detectors so that the points must lie for the right direction before the signal can be lowered. Of course the facing point lock guarantees that the points are tight up, but the connections to the switches might have failed and yet the lock could be shot. Detectors, therefore, make sure that the road is set for the direction indicated by the signal.

The use of "either position" locking, referred to in the interlocking requirements, has considerably increased in Great Britain during the last 15 years, so that it has now been included in the Board of Trade requirements. The object is to provide an extra safeguard against throwing a switch under a train.

It may have been observed that there is no reference to "derails" in the regulations. The same thing—"safety points"—is required upon freight and mineral lines and sidings at their junctions with passenger lines; but they are not allowed in main lines. In the case of a converging junction reliance is placed upon the block working to prevent trains approaching the junction from two directions at the same time. The same thing is done when two lines of road cross each other on grade; but there are only six or eight such crossings in the whole of Great Britain.

The height of platforms (3 ft.) will be noticed; and it will be remembered that English cars are built on the compartment principle—hence the continuous footboard.

The provision of runaway catch points on inclines is a requirement of much importance in Great Britain, where freight trains are not provided with continuous brakes, and often have many cars with no brakes whatever, and where breakaways cannot be controlled except by the brake van or caboose at the end of the train, which is usually not more than 24,000 lbs. These catch points have to be placed sufficiently far away so that a train standing at the home signal is clear of the points. The switches are provided with a spring to act as a cushion when the points are run through by trains, and to open them again when the train has passed through. A suitable place has to be found for the points, either on the level or in a cutting, but an embankment must be avoided. The position of each catch point is indicated by a board so that trainmen may know when they are near it.

Of course such points cannot be laid in single lines or they would become facing in one direction, and so at passing places a loop is made and catchpoints provided in one of the lines of the loop. All up-trains use this side of the loop, and the upper switch of the loop can, if desired, be kept normally set for this side.

When reading the regulations as to permanent way it must be remembered that British roads almost entirely—if not absolutely—use a bull-headed and not a flat-bottomed rail, and these are supported by chairs secured to the ties (sleepers) by three or four fastenings. The rails are joined together by a pair of fishplates, one on each side of the rail with four bolts through—two for each rail.

Public road crossings on grade are not allowed in new work and are slowly becoming abolished. Quite 90 per cent. of British public road crossings are protected by signals which in many cases are worked from standard signal towers. The road is fenced off by gates and not barriers, and in a large number of cases the gates are worked from the signal tower by a wheel interlocked with the signals. In country districts the gates are worked by a gatekeeper, who is generally the wife of a trackman, and resides in the gate-house, rent free, in return for the services rendered in attending to the gate traffic. It is the duty of the gatekeeper to put to danger the signals protecting the crossing before opening the gates. In order that gatekeepers may know when trains are approaching they are provided with electrical indicators working on the block wire. The number of accidents to road vehicles at highway crossings in the United Kingdom is remarkably few.

It will be noticed that a regulation as to highway crossings has been inserted to provide against trains switching over the crossings and stopping vehicular traffic. The Board of Trade are very jealous for the public convenience in this matter. Then it will be observed that near populous places the lower parts of the gates are to be close barred or provided with wire netting. This is to prevent children getting through on to the railroad.

Of the systems allowed for working single lines only very minor ones are now worked by staff and ticket, nearly all single lines being controlled by the electrical tablet or electrical staff. The train despatcher is not now known on British lines, the last railroad—the Highland—having adopted the electrical tablet.

The means of communication between passengers and trainmen was generally up to two years ago by means of a cord outside the carriage windows, but now all the British companies (except two or three who have an electric bell communication) have adopted a system whereby a chain passes through the compartment which, on being pulled, gently applies the continuous brake.

By Act of Parliament all alterations or additions to existing roads have to be submitted to the Board of Trade. In these cases only one plan is sent, which is a copy of the permanent way plan upon which is shown in red the alterations, also particulars of the signals.

Purely freight or mineral lines upon which passenger trains do not run need not be submitted for inspection, but should a freight line subsequently be converted into a passenger road it must be offered for inspection. Some British companies make a rule of submitting for approval the renewal of all signal towers, interlocking frames, and extensive alteration to signaling, although they are not obliged to do this unless the permanent way has been interfered with. It is done in order to obtain that satisfaction which comes from a knowledge that the Board of Trade have approved of the work.

After the inspection has taken place the Inspecting Officer makes his report to the Board of Trade, summarizing briefly the new line, the works on it, and in the case of alterations what these consist of. He then states what requirements or suggestions he has to make. It may be that a check rail has to be placed on a curve, or an embankment should be watched, as it shows signs of slipping; and in signaling that the position or shape of a signal should be improved; and in interlocking that certain points and signals should be interlocked. The Board of Trade send a copy of this report to the company, and where requirements are made, they ask to be advised when the work has been done. Where the requirements are many or important a re-inspection is ordered after the company have intimated that the wishes of the Inspecting Officer have been met.

The law of the land as to reporting accidents to the Board of Trade provides that railroad companies are to advise them of

1. Any accident attended with loss of life or personal injury to any person whomsoever.

2. Any collision where one of the trains is a passenger train.

3. Any passenger train or any part of a passenger train accidentally leaving the rails.

4. Any accident of a kind not comprised in the foregoing descriptions, but which is of such a kind as to have caused or to be likely to cause loss of life or personal injury, and which may be specified in that behalf by any order to be made from time to time by the Board of Trade.

In the last regulations issued by the Board of Trade and which are dated Oct. 31, 1895, it is laid down that the companies are to report every accident of the following nature.

1. As regards the locomotive power and rolling stock:
a. Bursting of a boiler.
b. Failure of a rope used in working an incline.
c. Failure of a wheel or tire.
d. Failure of an axle.
e. Failure of the hornplate of an engine.
f. Failure of the axleguard of any vehicle in a passenger train.
g. Failure of any other part of locomotive engines, tenders or vehicles not included in the above, which leads to an accident to a passenger train.

Note.—Any return of the failure of a boiler, a tire, or an axle should be accompanied by a diagram with particulars of construction and failure, and by a description of the nature of the materials it was made of, and the amount of work it had performed.

2. As regards the permanent way and works:
h. Fracture of a rail in the permanent way of a passenger railroad.
i. Bursting of the permanent way under a train on a passenger railroad.
k. Failure of a bridge, viaduct or large culvert or any part of them.
l. Failure of a tunnel or any part of it.
m. Failure of the roof or any important part of a station.
n. Important slips in cuttings or embankments.
o. Failure of a retaining wall.
p. Flooding of a portion of permanent way.
q. Failure of any other portion of the permanent way or works not included in the above which leads to an accident to a passenger train.

Note.—In any return of the fracture of a rail the form of the rail should be stated, the weight per yard, the material it was made of, the length of service it had done, the manner in which it was fixed, and if a double-headed rail, whether it had or had not been turned at the time it broke.

3. Miscellaneous accidents to rolling stock, and permanent way such as:
r. A train traveling in the wrong direction through points on the main line of a passenger railroad.
s. An engine or train running over any horse, beast or other obstruction or through the gate or gates of a grade crossing on a passenger railroad.
t. Any fire in any part of a train or at a station or involving injury to any bridge or viaduct on a passenger railroad.†

All fatal accidents occurring in the working of rail-

†Blank A for reporting all accidents except tire and axle failures, has 12 columns, which are headed respectively: (1) Date and time of day. (2) Nature and cause, place and name of any other railroad company interested. (3) Particulars of damage. (4) Name of person. (5) Nature of injury. (6) Whether passenger or employee, etc. (7) Whether injured person was at fault. (8) Copy of verdict at inquest. (9) Working hours of employee. (10) How many hours had he been on duty? (11) Was employee over or under 18 years of age? (12) Remarks. This form has 10 horizontal lines, but the widest of the columns is less

roads whether to passengers, servants of the railroad companies or other persons are to be reported by telegraph or otherwise within 24 hours after the occurrence of the accident, and non-fatal accidents to be reported by post as early as practicable. Non-fatal accidents to servants of railroad companies to be reported whenever they are such as to prevent the servant injured, on any one of the three working days next after the occurrence of the accident, from being employed for five hours on his ordinary work.

Non-fatal accidents to persons other than servants of the companies to be in all cases reported.

In nearly all cases of accidents to passenger trains an inquiry is ordered to be held, but in minor cases it is referred to the Inspecting Officers for advice as to whether an inquiry is advisable. Should it be clear that the mishap was a pure accident and not due to any defect in working or lack of supervision then probably an inquiry will not be held. But in most cases an inquiry is ordered.

The Inspector visits the scene of the accident, and is generally supplied with a plan of the place showing in the case of a collision the signals concerned, and the point of collision, and in the case of a derailment the place where the derailment occurred, the marks on the permanent way, and the final position of the derailed vehicles. The Inspector then takes the evidence of all the men who are concerned or can throw any light on the mishap.

In due time the Inspector's report is issued, copies of which are sent to the company and to the press. In these reports the circumstances of the accident are given, together with the injuries to passengers and staff, and the composition of the train or trains concerned. Then follows a description of the scene of the accident with details of the position, particulars of the signals, gradients, curves, view of line, and signals, etc. The evidence is afterwards given and then follows the conclusion in which is summarized the facts of the case, then the cause, and lastly any recommendations of the officer as to the steps to be taken to avoid future mishaps.

The parliamentary blue book contains inspectors' reports on 18 accidents. One of these was on the Liverpool Electric Railway accident. Some of the others were:

Collision owing to signal sticking off; more frequent inspection of wires recommended.

Freight train broke loose, and owing to irregular block working a second train followed, and a collision ensued, and into the debris a passenger train ran on the adjacent line.

Train turned on wrong line owing to towerman mistaking its destination during fog.

Passenger train shunted back on the side track, where freight train was standing, instead of on to the other main line. Fog at time. Fixed signals for switching recommended.

Engineer ran by signals at danger during fog.

Some wagons when being switched on a side track went out on to the main line owing to a point rod failing. Improved point connections recommended.

Collision during switching (fog at time). Fixed signals for switching recommended.

Collision (during fog) owing to irregular block working. Comments made by Board of Trade Inspector on "lock and block" release key.

Collision owing to engineer running by signals at danger during fog. The Inspector calls attention to the unsatisfactory state in which the electrical appliances are kept.

Collision owing to engineer passing signals at danger during fog and ignoring torpedoes.

Derailment at curve. Speed restriction to be better attended to.

Collision due to engineer passing signal at danger during fog.

Buffer stop collision.

Collision due to irregular working during fog. Fog regulations to be made clearer.

Collision due to irregular block working. Better supervision of towermen recommended.

All the reports and recommendations are made in a very unprejudiced manner, and where a company deserves censure it is given. Sometimes in the rare cases of fatal accidents to passengers where technical questions arise, the Inspecting Officer acts as Assessor to the Coroner (at the request of the latter) when the inquest is being held. Where criminal proceedings are being taken or may be taken, the officer's report is kept back and not published until such proceedings are over.

In 1895 two Sub-Inspectors who had had railroad training were appointed to hold inquiries where railroad servants had been injured, and in 1900 two Assistant Inspecting Officers were appointed in consequence of the extra work thrown on the Board of Trade by the Act for the "better prevention of accidents on railroads."

These four gentlemen hold inquiries into certain of the cases where railroad servants meet with accidents, and their reports and recommendations are briefly summarized and appear in the blue book.

The bill for the "better prevention of accidents on railroads" already referred to, prescribes certain rules for working railroads, and these rules have now been confirmed. [See *Railroad Gazette*, July 5, 1901, where the requirements are given as originally prescribed. Before confirmation they were modified in some particulars, chiefly by extending the time for providing certain safeguards.]

Two other duties of the Board of Trade Inspecting Officers should be named. 1. To hold inquiries as to accommodation given to workmen to get to and from their work. 2. To carry out the requirements of the Railway Servants' Hours of Duty Act 1893, sanctioned to prevent railroad men being kept on duty too long, and ensuring that they get sufficient rest.

The present Inspecting Officers are Lt. Col. H. A. Yorke (Chief Inspecting Officer), Lt. Col. P. G. Von Donop, Major E. Druitt and Major J. W. Pringle, all of the Regiment of Royal Engineers. The assisting Inspecting Officers are Mr. John P. S. Main and Mr. J. H. Armytage, and the sub-Inspectors are Mr. J. H. Hornsby and Mr. A. Ford.

Track in Tunnels.

In the *Railroad Gazette* of July 11, there appeared under the above heading, so suggestive an editorial that no trackman, active or retired, who read it, can escape the questions which it must have aroused in his mind. Because, the principles there laid down, involve all railroad track, and any very great improvement which might come from an investigation into better methods or devices for use in tunnels, is sure to work for the ultimate benefit of track in the open air. Indeed, so important is this subject, that it will excuse a great deal of writing and talking (trite though it may seem to some engineers) in the effort to bring out something new and useful.

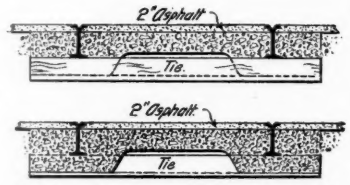


Fig. 1.—Experimental Concrete Track.

This editorial presents for consideration the fact: That in consequence of the confined space and the small interval between trains, the cost of track repairs in tunnels may become excessive. In other words, this means that the more permanent the track and the more conveniently repairs can be made (when they ultimately become necessary) the more nearly will the track approach an ideal condition. But the field covered by this editorial is too broad for a single discussion, when it couples the conditions as they exist in such tunnels as run west from Jersey City, Hoboken and Weehawken, and in the perfectly dry, well-lighted and well-ventilated subway now being constructed through New York City. What is here written, therefore, will strictly apply only to the latter specification.

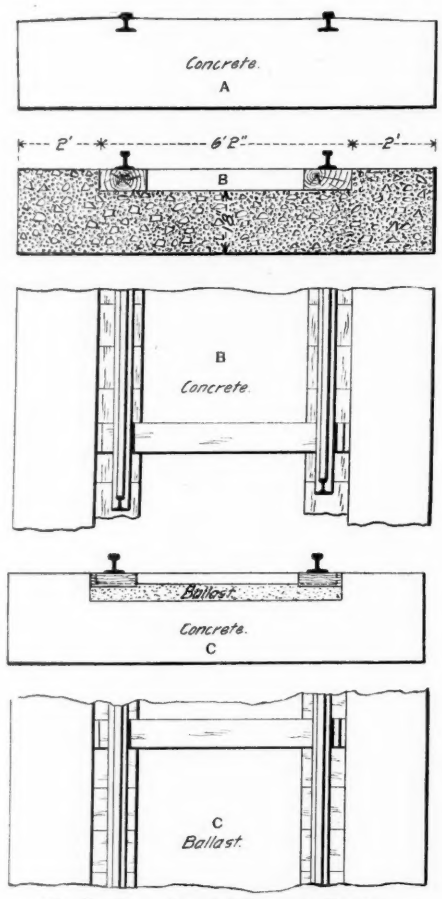


Fig. 2.—Experimental Concrete Track.

In the near vicinity of New York City, there are two semi-experimental pieces of track which have been tried out in the furnace of a hard service. Of these two, the first, Fig. 1, was laid in a city street about three years ago, and, since then, has borne a constant traffic of the heaviest type of electric tram-car. The rails are of the usual pattern, 80 lbs. to the yard, 9 in. high, 5 in. base; the joint fastenings are the familiar fish-plates common on such rails. The essential feature of the whole construction is the embedding of the rails in an unbroken matrix of concrete, and the one essential weakness is *at the joints*. Otherwise, it would be difficult to find a better piece of track, except in one particular which, however, does not involve the fundamental idea. At certain spots the street has been excavated for various purposes, often in freezing weather and, when re-filled, the earth was thrown in without sufficient tamping; at these spots the track has settled, sometimes considerably, but nowhere to an extent which is dangerous, even at high speeds.

As this form of construction is considered, two facts impress themselves strongly: The rail shows very little wear on the top and no tendency at all to separate or loosen itself from the enclosing concrete; and the concrete bed has maintained its continuity, apparently without a crack. From the first of these statements, one inevitably concludes that the vertical strength of the rail is enough to prevent any appreciable flexure; and the second statement proves that continuous, shallow beds of concrete are in no danger of developing serious cracks where the supporting earth is at all uniform in density.

The failure of the joints must be due to but one cause: The breaking down of the fiber of the wood at the weakest part of the rail. This is clearly shown by the fact that, so far as could be seen, there was no failure in the rail directly opposite the joint, although this rail is supported by the other end of the wooden cross-tie.

The second piece of track (see figure 2) was built for a heavy passenger traffic of ordinary coaches drawn by steam locomotives, and it shows but one thing, except negatively. This one thing is valuable since it agrees with the observation made on the street railway track: That long stretches of concrete may be depended upon not to crack if the sustaining earth presents an approximately uniform resistance. And if earth furnishes these conditions, how much better will they be secured in such a tunnel as is being built in New York City? It is clearly proved also that even a 100 lb. rail of standard section is not deep enough under the conditions of load. The mass of concrete has not given way, but the rail, A, Fig. 2, (where it is wholly embedded) has freed itself by pulverizing the surrounding medium. Where the rail rests upon wood, it is unevenly supported upon short blocks, which are, in separate stretches, placed directly upon the concrete, (B, Fig. 2); or supported by a film of broken stone ballast (C, Fig. 2); but wherever they exist, the track is flimsy and will require careful attention.

Of all the lessons taught by these two pieces of track, the futility of plain angle—or fish-plates stands out most clearly. On the street railroad and steam railroad alike, they are the weakest point and the story which they tell is in words of one syllable.

In both cases, too, it seems perfectly evident that metal cross-ties would have been much better than wooden ones.

As a final conclusion, there remains little doubt in the writer's mind that an extremely permanent, continuously supported railroad track can be constructed from existing materials, the repairs to which shall be sufficiently convenient for even the heaviest traffic in the New York subways.

GEORGE HEBARD PAINE.

Progress of the Lake Shore-Rock Island Chicago Terminal.

The new Lake Shore-Rock Island passenger terminal building in Chicago, and described in our issue of March 14, is to be four stories higher than originally planned. This addition will provide a considerable increase of office room for the two roads owning the station.

Work on the station is progressing very satisfactorily. The steel for the second story is being erected and the work of laying the granite, which will compose the first two stories, has been begun. The plans for the terminal include the elevation of the 11 tracks entering the train shed, the train floor being at the level of the second story of the building. This train floor is to be carried on steel plate girders resting on steel columns, and this steel work is likewise well advanced. All foundation work has been completed and the columns for supporting the roof trusses of the train shed are being placed. These latter will be bow-string trusses of 212 ft. span and will support concrete and expanded metal tiles. The contractors, Grace & Hyde, expect to make these tiles on the ground and are now experimenting to obtain a mixture suitable for the purpose. It is also of interest in this connection to state that they used the stone from the old station, which stood on the site, for concrete for foundation work, a crushing plant having been put in for the purpose.

The station faces on Van Buren street. Across Har-

than 2 in. wide, so that it would seem that the Board of Trade does not expect a very full statement of the particulars of damage, or of the nature and cause of the accident.

Form B, for reports of broken tires, has 20 columns, providing for a pretty full description of the tire, a minute description of the fracture, number of miles which the tire had run, etc. Form C is a similar blank, for reporting broken axles. In this report there is a column for "material of axle and name of maker;" though in Form B there is one column for material (only) and another for the system of fastening and the name of the patentee.

rison street, which is one block south, and under the elevated tracks, will be situated the power station for lighting and heating the terminal. Work is under way on this building also. The boiler room is to be below the ground level and the engine room floor. There are to be five 300 h.-p. Cahall boilers and a complete coal and ash-handling plant will be installed. The engine room will contain one 800-h.-p. engine, direct-connected to a 500-k.w., 250-volt, direct-current generator, and two smaller units composed of 380-h.-p. engines, direct-connected to 250-k.w. generators. The engines will be Buckeye cross-compound non-condensing, the large unit running at 150 r.p.m. and the smaller units at 200 r.p.m. The generators will be supplied by the Western Electric Co. Water will be obtained from an artesian well on the premises and will be pumped by compressed air. A compressor of suitable dimensions will be installed in the engine room. The heating system will be the Webster vacuum system, using exhaust steam. The brick stack for the power station will be 7 ft. in diameter and 175 ft. high.

The Master Blacksmiths' Convention.

The tenth annual convention of the National Railroad Master Blackmiths' Association opened in Chicago on August 19 with the largest number of delegates present in the history of the Association. Mr. Thomas Erskine, Acting British Consul, at Chicago, gave an address. A brief response was made by President Savage, after which he delivered his annual address. Buffalo was selected as the place of meeting for 1903.

The following officers were elected: President, John McNally, Chicago, Ill.; First Vice-President, George Lindsay, Evansville, Ind.; Second Vice-President, T. F. Kirne, Hilburn, N. Y.; Secretary and Treasurer, A. L. Woodworth, Lima, Ohio; Chemist, G. H. Williams, Boston, Mass.

Reports by a number of committees were then presented and are given in part, below:

REDUCING BLACKSMITHING TO UNIFORM METHODS.

The most important member in train service is the draw-bar strap, as it bears the strain of the whole train. Ofttimes on the steep grades in the California mountains the bolts that grip the draw head are sheared, and the lips are found to be defective in the inside of the bent angle. This member is not produced by uniform methods in the different railroad shops. In many shops the attempt is made to bend the lip over the front edge of the anvil and square it up afterwards. This method is not practical, as it is not possible to bend a piece of iron 4 in. by 1 in. with a ⅝ in. lip without impairing the strength of the metal at the bent section. In nine cases out of ten what is termed a "cold shut" is produced on the inside of the sharp angle.

Another method practiced in some shops is to weld a lip of the proper dimensions on the bar and produce a square corner on the outside as well as on the inside. This method when properly done will answer all purposes, but is too slow and expensive. Recently I noticed a complete sketch of a machine for producing this member in one heat; the extra length of the lips, after being bent, was cut or sawed to the required length. As before stated, this method leaves a weak section at the sharp angle forming the lip.

From my point of view there is only one method by which the lips of the draw-bar strap can be produced economically without impairing the strength of the metal at the point where the strength is required. Instead of the metal being increased by bending it can be increased to any proportion desired by producing the lip in a forging machine in a similar manner to heading bolts. The dies should be cut out to correspond to the outline of the lip required. One revolution of the machine, when iron is placed between the dies at the proper heat, produces the required projection in perfect shape; after the lips are formed on each end of the bar the iron is reheated and the back bent to shape in the bulldozer.

This report is signed by Mr. S. Uren.

Mr. Thomas C. Lace suggested that fork welds be used for motion work; first, because they can be easily made; secondly, that they are stronger than the lap weld; and thirdly, that they can be made in nearly the same time. The chances of breaking above or below the weld are also reduced to a minimum. A weld should be taken in a covered or hollow fire.

CASE HARDENING.

We recommend an oil furnace placed close to the ground so that the work can be easily removed from the furnace without raising or lowering the boxes. The vat should also be placed on the ground, with the water coming in from the bottom end. An overflow pipe at the top should be provided. A piece of perforated plate should be placed about 4 in. from the bottom of the vat and above the inlet. The boxes should be about 12 x 30 in. long, with lids to suit, for such work as links, pins, bushings, etc.

In packing boxes for large work, about a 2 in. space should be left between the pieces; for lighter work, a 1 in. space is sufficient. In heating the work, the fire should not be urged too much at the start. After the box is hot, it should be kept at a constant temperature for five or six hours.

This report is signed by Messrs. W. Hodgetts, H. Harris and H. Hinkens.

THE OIL FURNACE—BEST FORM.

A foreman blacksmith presented the following as practice in his shop: In our bolt furnaces we use water fronts, with 2-in. water space. They have a ⅜-in. feed pipe at the bottom, and ¾ in. waste pipe at the top. The inside space is 7 in. wide, 3 ft. long and 2 ft. high, with a 4 in. wall all around. The opening for bolts holds about 150 ⅝-in. bolts. The only trouble we have is that of lining up the furnaces on the front about once every two weeks.

For heavier forging or bending we have a heating furnace with no water front. This furnace is 3 ft. long in the clear and about 10 in. wide on the inside, with two ordinary pipe burners, one at each end. The furnace is 24 in. high in the clear inside. We bend all our transoms from this furnace. The iron is 1 in. x 7 in., with a double bend on the ends. We put three of them in at a heat, and it takes only 3 to 4 minutes to heat to a white heat.

The spring furnace has two burners at the end. It is built on the same style as a scrap furnace, with the stack lined with brick, and with two partition walls every 24 in., having a double row of holes every 4 in.—2 in. x 4 in. openings for the blaze to go through. In the front part we make our arch-bars, brake-levers and all other work commonly made with a bulldozer or steam hammer. This compartment has a sand bottom. The next compartment is used for spring making, and has a brick bottom. We also do all our case hardening and annealing in it.

The axle furnace, which is the largest furnace we have, is divided into two parts, with one partition wall 24 in. high in the clear, with a door 18 in. sq. This furnace has a sand bottom. It has three pipe burners at the end, near the top. An arch in that part, 20 in. high, extends across the furnace. Four in. openings spaced 4 in. apart admit the flame to the other compartment.

FLUES.

The first thing to be considered is the formation of the joints. This may be done by the lap weld, the butt weld or the scarf weld. The butt weld we will not discuss, as I believe it has passed into disuse. The lap weld in which the tube is enlarged sufficient to admit the safe end, is, in my opinion, not a proper form of weld for the following reasons:

First.—When the tube is subjected to the pressure of the rollers, the excess metal will form a ridge on the inside of the tube, thereby reducing its size.

Second.—If the flue is expanded by a mandrel, there will remain a certain amount of dirt at the joint. This upon becoming heated to a welding heat, becomes dross. This dross during the process of welding, if done by the roller, forms into two masses and is deposited just back of the point at which the rollers come into contact with the flues, and as this will not fuse with the metal of the flue, you will have two spots on each which have been welded. This may or may not leak, but they both go to weaken the weld.

I wish now to draw attention to the scarf weld. By this process we ream out the flue to a distance of ½ in. The safe end is accordingly pared down and when placed within the scarfed end of the flue, forms a close and clean joint. Both the outside and the inside of the flue are thereby kept in the same line, and, as the pressure of the weld is brought upon the flue, the metal will not upset and form itself into ridges and masses. The machine used by us at the Buffalo shops enables us to both weld and swedge down the ends for the flue sheet on the same heat.

The report is signed by Mr. T. J. Riggs.

REPAIRS TO LOCOMOTIVE FRAMES.

Frames with small cracks can be easily and quickly repaired by cutting out to the depth of crack, and with a suitable tool back up sufficient stock for a good heat. Make a V of proper size, take separate heats, weld and work smooth, and frame is ready to put up without any machine work. Splitting and putting in a "dutchman" is bad practice and should not be permitted. The V should be so made that the fiber of the iron will be in the same direction as the parts to be welded. In making V welds in heavier parts of a frame, the scarfs, when put together, should be not less than a right angle.

Steel frames are as yet not much in evidence; seems to be an expensive luxury that only a few roads can afford, and when you have them, make up your minds to repair, for it is sure to come, and often in several pieces. We repair them the same as we do iron frames, and always use a V weld if possible; making the V of iron, and then we look every time the engine comes in to see if it is broken.

We have noticed where some of the craft, with the assistance of the roundhouse foreman, have found it unnecessary to remove broken frames to repair. This might be practical if we could pick the place for the frame to break. We have all seen the genius who welded the steel driving tire—he didn't expect it to stand, but it was welded all right.

The report is signed by Messrs. W. C. Scofield and F. Peck.

The Baltimore & Ohio is to destroy something over two thousand of its old freight cars. Nearly or quite all of these cars are of 40,000 lbs. capacity, which serves as a reminder that 15-ton cars have long since become "back numbers." It is said that a number of other roads, including the Atchison, the Burlington, the C., C., C. & St. L. and the Illinois Central, are to break up many cars, so that in all 15,000 cars will be destroyed within a month or two. This must have an appreciable effect on the scrap-iron market.

Proper Method of Counting Cars in Figuring Cost Per Car at Terminals.*

There are so many and such varying conditions that enter into the cost per car for handling over yard terminals that it is often difficult to explain differences in the figures. Aside from the question of management there are the following principal items which affect the cost per car:

Capacity of yard and arrangement of tracks.
Size and condition of switching engines.
Number and character of private industries.
Character of the traffic; that is, the proportion of perishable freight and of passenger train work.
Promptness with which cars are taken away by trains.

In Kansas City there are as many different methods of counting as there are railroads, and the figures showing cost per car will run all the way from 10 cents to $1.00. They have absolutely no meaning so far as the comparison of one yard with another is concerned.

A few of the different methods are:

First.—Cars received and forwarded in trains;
Cars delivered to and received from connecting lines;
Cars delivered to and received from private industries;
Cars to and from freight house and team tracks;
Cars to and from coal chute track;
Cars to and from transfer tracks;
Cars weighed.

The total of these items is the number of cars handled; it is necessarily three or four times greater than the actual number of cars handled.

Second.—Cars received and forwarded in trains;
Cars received from and delivered to connecting lines.

These are known as the recorded movements, and at a strictly terminal point would make comparatively little duplication, as only a small proportion of the cars make the two movements on the same day.

Third.—Cars received and forwarded in trains;
Cars switched for revenue.

The latter item includes only switch cars not received or forwarded in trains, such as cars received from a connecting line to unload on some private industry track, and the empty returned, or an empty received from a connecting line to be loaded and returned, the movement of the load and the empty only counting as one car. At a terminal point there is small chance of cars being counted more than once under this method, and the total may be taken as the actual number of cars handled.

At a division point or a terminal where trains are received and forwarded in more than one direction, many cars would count twice, for the reason that they are counted in in one train and out in another, probably on the same day. However, with the exception of a very few through trains they would be handled twice—once in breaking up the inbound train and again in making up the outbound train.

Fourth.—All cars received in trains and from connecting lines.

The object being to count each car only once. This would give the actual number of cars over terminals, but would give no idea of the work involved in handling same.

Fifth.—Cars in and out in trains—freight and passenger;
Loads switched and transferred. (The loads transferred being doubled to take care of the load in in one car and out in another);
Company material;
Cabooses.

This last method of counting was made uniform on one large western road. Just why they considered it proper to count cars of company material and cars transferred the second time, and not count cars going to private industries, freight house and team tracks, I am unable to say.

It will be seen that the cost per car must necessarily vary widely. I feel safe in saying that there are to-day no definite ideas among railroad men that will anywhere near approximate each other as to what is a proper and reasonable cost per car for handling terminal work.

To arrive at some uniform method, not only of counting cars, but as to the items of expense to be included; so that some definite idea can be formed as to what is a proper and reasonable cost per car is very desirable.

At Kansas City in one yard where they worked eight switch engines during the 24 hours and counted their cars according to the first method mentioned, including all internal movements, they showed a total of 40,000 cars handled and cost per car of about 10 cents.

In another yard, where they worked an average of about 24 switch engines during the 24 hours, but counted their cars according to the third method mentioned, that is, cars in and out in trains and cars switched for revenue, being strictly a terminal point on that line there was no duplication of cars, and they averaged about 30,000 cars per month, and their cost per car was about 50 cents.

On another line, where they counted the recorded movements, that is, cars in and out in trains, and to and from connecting lines, and this line having trains in and

*A paper by R. V. Miller, Trainmaster of the St. Louis & San Francisco, read at the Annual Meeting of the Central Association of Railroad Officers, July 23, 1902. Condensed.

out in two directions, the number of cars handled averaged about 50,000 cars per month and the cost per car about 25 cents.

I found that by actual count the line handling the 30,000 cars would, under the method of counting last referred to, that is, in and out in trains and to and from connections, have handled 60,000 cars at a cost per car of 25 cents. The terminal superintendent in his anxiety to increase the number of cars handled and thereby reduce the cost per car may reduce it so that he will prevent improvements, as his superior officers may conclude that improvements are unnecessary where cars are already being handled so cheaply.

The larger proportion of the items that go to make up the terminal expense are daily wages of yard and engine men. The number of engines required to handle the work is the number per day of 24 hours and not the number per month. At a strictly terminal point not over 50 per cent. of the cars are received in trains and delivered to connecting lines the same day. In the meantime they are being handled to house tracks, team tracks, private industries' tracks, and hold tracks. Suppose that you receive in your yard in trains to-day 300 cars, and that you deliver 300 cars to connecting lines that have been received on previous days. Then you have actually handled 600 cars on that day, but you only get credit for 300 if you count a car but once. Let us assume that you receive from connecting lines 200 cars grain in one day, on which you do not get billing for three days, which is not an unusual occurrence. These cars go into your hold tracks and are handled every day in getting cars out, but you receive no credit for the work.

I feel safe in saying that every car handled through the terminal yard will make an average of three distinct movements before it is disposed of. I think the proper method is a daily count of the cars

Received and forwarded in trains;

Received from and delivered to connecting lines.

These are the channels through which cars pass in and out of the yard—the recorded movements. The terminal superintendent should be furnished with a daily statement of these recorded movements as soon as practicable, so that he can watch the expenses; and the total of these daily statements at the end of the month should form the basis of his "Cost per Car."

The items of expense to be included in these statements should be those that have to do directly with the handling of cars in the yard and over which the terminal superintendent has control, such as yardmasters, yard-clerks, switchmen, switchtenders, switch engineers and firemen.

If such items as the Repairs of Engines, Maintenance of Track, Damage to Equipment and General Expenses are included, your total expense may be highest when business is lowest and the item of "Cost. per Car" becomes worthless as a basis of comparison.

While the foregoing is my recommendation as to the proper method, I think any method is desirable that can be uniformly adopted; but even with a uniform method, there would still be a considerable difference in the figures for different yards on account of the varying conditions of terminal facilities, power and the character of traffic. The cause for the difference could be definitely located, however, and might result in much good in the way of improved facilities and methods of handling. As a rule, terminal facilities have improved less than other features and have not kept pace with the constantly growing traffic; hence the adoption of a uniform method for arriving at the "Cost per Car" may show many of us that on account of inadequate power and facilities our terminal work is costing us too much.

The High Speed Brake.

At the meeting of the Central Railway Club this evening (Feb. 12) Mr. F. M. Nellis submitted a paper continuing the discussion on the high speed brake, brought over from the May meeting. Extracts follow.

Possibly one of the greatest converters of foundation brake gears from the light and flimsy kind to the stiff and rigid gears was the automatic brake slack adjuster. When the adjuster was first introduced it was found to take up the slack so tightly on cars that the shoes rubbed the wheels and dragged when the brakes were released. The manufacturers of the adjusters, however, were quick to see that the foundation brake gear was entirely too light, and permitted a springing of the parts which militated against a proper performance of the adjuster. The matter of stiffer gear was urged by the slack adjuster manufacturers, but insufficient heed was given at that time to their urgings. Later on it was found that not only should the foundation brake gear be stiffer and more rigid, but that larger brake cylinders than were ordinarily used would give a better performance of the adjuster, and that a total leverage of seven to one gave best all-round results.

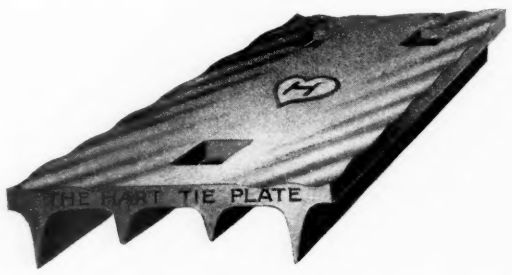
With the introduction of the high-speed brake, it was found that the foundation gear on many cars would have to be strengthened and made heavier. This has been done with very satisfactory results. Lately, the roads using the high-speed brake have been paying more attention to the matter of stiffer foundation brake gear, and have increased the size of the parts in order to obtain the highest possible assurance against breakages and consequent troubles. The permissible stress per square inch, cross sectional area, for rods and levers of foundation brake gears adopted by the Westinghouse Air-Brake Co., and recommended by them for some time past, has been 20,000 lbs., and the same has been in practice on the Pennsylvania Railroad up to the present time. I believe they still employ that amount as their standard stress. The New York Central, however, have believed that they should decrease the stress per square inch on the rods and levers, and have accordingly lowered the permissible stress to 17,000 lbs. This change seems to produce the feeling of greater safety on the part of the designers.

The hose problem has not passed through the same development as has the foundation brake gear for high speed brakes. It seems, however, that the hose have been sufficiently strong to withstand the higher train pipe pressure carried by the high speed brake. Several years ago, when the New York Central first equipped its Empire State express with high speed brakes, it applied to one of the prominent rubber manufacturing companies to supply a stronger hose for this unusual service than was being supplied generally for trains in ordinary service. The rubber company complied with this request, somewhat reluctantly, as it believed its standard four-ply hose amply adequate, and furnished a hose of five plies in thickness. This special hose was run for the term of one year on the Empire State express, then taken off, regardless of whether it showed any signs of wear or deterioration, and placed in ordinary service. A new hose was supplied to the high speed brake train. This practice held for two or three years, when finally the ordinary hose of four-plies was taken up and used in high speed brake service the same as in ordinary service. There was, therefore, but one class of hose for the service of both. To-day the New York Central Road is running a four-ply hose as they formerly did on cars in their ordinary service, with the exception that the hose is perhaps better because of being manufactured according to the specifications of the New York Central motive power department.

No trouble has been experienced from the failure or inability of a good standard air-brake hose to withstand the higher pressure employed in high speed brake service. It would seem that it is not so much a question of a hose of greater thickness or more plies as it is of hose of a good quality of rubber and duck, well manufactured.

The Hart Tie Plate.

A new tie plate is shown in the accompanying illustration. It is the Hart tie plate, designed by Mr. H. H. Hart, Chicago. Mr. Hart has not only endeavored to meet the fundamental requirements which authorities on tie plates say should be embodied in their design, but he has also added certain features which are intended to overcome difficulties which have previously been encountered in tie plates.



One of these features is the camber given to the top surface by thickening the section of the plate along the longitudinal center line. The top slopes toward each side from the center. The object of this is threefold. If the top of the plate is flat, sand may accumulate between the rail and plate, cutting both and causing rapid wear. As the rail is in contact with the Hart plate only along the center line the accumulation of sand between the two, and the cutting effect, are reduced to a minimum. The cambered surface also acts as a natural shed for water, brine, acid or other drippings from the cars. The third point is the increase of the adhesive qualities of the plate to the tie by minimizing the effect of the wave motion of the rail on the plate, and also to prevent buckling. The wave motion of the rails, the effect of the rolling load, is excessive where the load is heavy, the rail light and the ballast poor. By narrowing the surface of contact between the rail and plate practically to a line the rocking motion that must otherwise be imparted to the plate, loosening it in the tie, is eliminated.

Another feature peculiar to the Hart plate is the corrugation on the upper surface. As seen in the engraving, these corrugations begin near the median line and run obliquely, gradually widening and deepening as they approach the outer edges of the plate. They are intended to assist the camber in forming a means for shedding foreign matter from the top of the plate. They are also designed to add strength to the structure.

The longitudinal flanges on the under side of the plate are designed to compress the fibers of the wood and firmly imbed the plate in the tie. The distribution of the metal in the plate is intended to give the greatest possible transverse strength, to prevent buckling and rocking.

These plates are rolled in 4¼-in., 5-in. and 6-in. widths, with thickness and length to suit requirements. Their manufacture and sale are controlled by George Fuller, Old Colony Building, Chicago.

Modern Car Design and Construction.

BY C. A. SELEY.*

The great advance in car capacities has so far outstripped the old 20-ton and smaller equipment that the question of designing cars of 40 and 50 tons capacity leads to new paths of practice and the use of new materials. The giant strides of the Pressed Steel Car Company and the influence of their designs towards decreasing dead weight and the consequent increase in the percentage of revenue freight carried, marks an epoch in the history of car building.

One would be foolish to say that the 50-ton car is the limit, although there are signs that we cannot go much further on present lines. Take, for instance, a 50-ton car, and if a 10 per cent. excess load is allowed, the total live load is 110,000 lbs. Add to this 40,000 lbs. for dead weight, and the total for eight wheels to carry is 150,000 lbs., or 18,750 lbs. per wheel. There are not many engine drivers as heavily loaded as that, yet we expect a common cast-iron chilled wheel to perform this service.

It is quite true that many 50-ton cars do not weigh 40,000 lbs., but they do not weigh so much less as to materially affect the argument. For coal carrying, the weights of various designs of 50-ton cars run from 35,000 to 40,000 lbs., and it is believed that the lighter weights than these are of designs that may need strengthening and re-enforcement sooner than is desirable. There are ore cars and others for concentrated lading of 50 tons, which require less cubical capacity and therefore can be made of lighter weight than the above figures.

Efforts have been made by some to attain a light weight by making light trucks, but these are almost uniformly unsuccessful.

Now what are the probabilities in the design of 50-ton cars? Say it shall carry 110,000 lbs. maximum and that the percentage of revenue freight shall be 75 per cent. This means that the light weight shall not exceed 36,666 lbs., and that the ratio of dead to live load is 33 1/3 per cent. If the trucks are to weigh 15,000 lbs. it will leave 21,666 lbs. for the body. This is feasible, but not in a wooden car; the frame at least must be of steel, the castings of malleable, and all members carefully calculated.

In view of the many difficulties in the design and operation of 50-ton cars, the necessity for strengthening bridges and permanent way of many railroads not now adapted for such wheel loads, and the safer load for the ordinary cast-iron wheel, the prediction is ventured that the 40-ton car will be very generally adopted in the next few years. It is feasible to build 40-ton capacity hoppers or gondolas to carry 88,000 lbs. with a ratio of dead to live weight of 37 per cent., which means 73 per cent. revenue load, or 2 per cent. less than is stated for an ideal 50-ton car.

I have never been able to understand the necessity for a 40-ton capacity box car except for the grain carrying roads, and the advent of 50-ton capacity cars is a still greater puzzle.

Owing to the weight of the superstructure the average design of 40-ton capacity box cars will not carry over 70 per cent. of revenue freight, as a well designed car and trucks to carry 88,000 lbs. will weigh in the neighborhood of 37,000 lbs., new. It is possible to reduce this weight somewhat as has been done in many cases, and this would doubtless do very well in mixed traffic, as of all cars the box car is most generally loaded below its capacity.

Formerly there was little or no thought of carrying the load except by the under framing. The sides of the car were merely thought of as necessary to retain the load, and the utilization of the sides of gondolas and hoppers, for a through, uninterrupted truss was not taken advantage of until late years. Indeed, it has been proposed to transfer most of the weight of the lading between the bolsters to the sides and thence to the outer ends of the bolsters, but this is not desirable. The value of the center sills for other offices than carrying is lost sight of. With the heavy tonnage trains and great tractive power now employed, it is necessary and advisable to use heavy sills and draft gear connections. It has also been proposed to have such heavy center sills as to bracket out from them and thereby carry most of the load, but this has not been employed to any extent, and it would probably make a very heavy car.

In steel there are a number of suitable sections of rolled shapes or a pressed or a built-up section which may be employed for sills. In wood construction the center sills may very profitably be heavily re-enforced on the underside between the bolsters, so as to minimize the bad effect of underhung draft gear in transmitting heavy buffing stresses. It is also good practice to truss all sills except the side sills of wooden cars, but that this may be successfully practiced there should be good body bolsters and needle beams and the side framing should be well done, in order to support the sides between the bolsters and needle beams. Proper attention is not paid in all cases to locate the truss rods, so that, for an equally distributed load, the rods will be uniformly loaded.

The history of the development of the composite cars of the Norfolk & Western is instructive, overthrowing as it does the old theory that the carrying strength of the car must be provided in the under-framing. In 1899 this road built 1,000 50-ton hopper cars with steel under frames and wooden hoppers. These cars carry 110,000 lbs. and weigh on an average 39,600 lbs. after nearly

*From a paper read before the Richmond Railway Club, May 8, 1902.

three years service. This is a ratio of dead weight to paying load of 36 per cent., or a revenue freight load of 73.53 per cent. The following year there were built 500 flat bottom, drop-door gondolas, which were 33 ft. long, 8 ft. 9½ in. wide, with sides 4 ft. 6 in. high. Average coal would load these cars to 88,000 lbs., but as much of the coal handled by the N. & W. exceeds the common average weight of 52 lbs. per cu. ft., giving an overload, the cars were stenciled 85,000 lbs., and their average weight is 32,500 lbs.

With the customary excess lading, the ratio of dead weight is 34.8 per cent., revenue load 74.2 per cent. Comparing then these two cars it will be seen that, although the latter is of a lighter capacity, it represents a gain in carrying capacity in proportion to the dead weight. This was brought about to some extent by making a steel truss for the side frames, lining and flooring the car with wood. I believe this design of car was the first, employing the construction described, to be made in any quantity in this or any other country. The car was a complete success from the beginning, and, although a radical departure in car construction, no defects have become apparent, and this year the N. & W. are adding to their equipment by purchase and building 2,500 more of these cars, to be made in accordance with the original design.

The success of these cars proves that it is not necessary to provide the carrying strength entirely in the under framing. They have heavy center sills to withstand the heavy pulling and buffing strains incident to heavy tonnage train service. The sides, while light, are immensely strong vertically and reasonably so laterally, in fact, were it not necessary to secure lateral strength we could use much lighter members for the side trusses.

Last year (1901) it became necessary to add to the road equipment of 50-ton hopper cars, and instead of duplicating the four sill design of 1899, a new design, employing a steel truss side was made and 900 cars were built, which at once demonstrated their superiority over the former design by reason of lighter weight, and at the same time being stiffer and stauncher in many respects. These cars now stencil 38,000 lbs. on the average, which represents a gain in weight of 1,600 lbs. under their predecessors. Their weight represents a ratio of dead weight to live load of 34.5 per cent. and a revenue carrying capacity of 74.3 per cent.

These cars have heavy center sills, carrying approximately 55 per cent. of the load, while 45 per cent. is carried by the truss sides to the bolster ends. No defects have appeared in this design, and the N. & W. are preparing to build 750 more of them in the near future on the same identical lines of framing. We also have on order 750 40-ton hoppers of a similar design, modified for that capacity.

We are building some steel frame box cars of 40 tons capacity. These are a new, untried design and are therefore to some extent experimental. They have steel under, side and end frames, up to and including the plates, with the usual wooden flooring, lining, sheathing, and roofing. Some of our bridge building friends here may think that a truss with the center diagonals omitted is a rather poor truss, but I have reasons for believing that we have a good car, notwithstanding there are no X braces in the door ways. Steel in box car construction is not as interesting a proposition as in hoppers and gondolas or flat cars. Much wood has to be used for nailing strips for securing lining, sheathing, and floor. We have found that we can make a steel frame box car 1,500 to 2,000 lbs. lighter than our wood frame car of same capacity and same interior dimensions.

I am of the belief that the steel car has come to stay; that while education and experience are necessary in all departments of railroads to handle them; in design, in operation, in wrecking, and repairing, yet the American railroads are too progressive to neglect an opportunity to use a most valuable material and to lead the world in car construction.

New Interlocking at Many Places.

That interlocking switches and signals have become a necessity on American railroads, and are every day coming to be looked upon by fewer managers as an extravagant luxury, has for some time been apparent from the frequent items of news of new plants being built, and particularly from the statistics lately published by the American Railway Association, showing 40,000 levers in operation on 84 roads. As, however, most news items refer to large plants in cities and to the largest railroads, a more accurate idea of the universality of this improvement can be gained from a list like the following, including a number of small plants scattered over a large territory. This is a list, just made, of the contracts which one of the prominent signal companies, the Standard, now has in hand. Each item represents, presumably, mechanical interlocking.

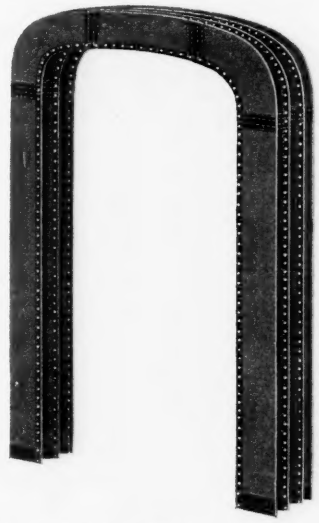
Contracts Under Construction and Not Completed.

No.	Place and Railroad.	Work.	Spare.
244.	Enid, B. E. & S. W. (S. L. & S. F.)	19	5
257.	Tiffin, P. L. W. of P.	60	8
271.	Walbridge, P. L. W. of P.	62	22
279.	Avilla, P. L. W. of P.	44	4
283.	Atlanta, C. & A.	18	6
286.	Reduction, B. & O.	24	4
289.	Piedmont, B. & O.	17	7
292.	Tabaloapa, K. C., Mex. & Orient.	12	4
293.	Clifton Heights, St. L. & S. F.	46	2
297.	Moorhead, Great Northern.	34	6
300.	St. Albans, N. E. E. R. R. C. Co.	4	4
309.	Air Line Junction, T. Ry. & Ter. Co.	35	5
312.	Livingston Avenue, D. & H.	25	7
313.	L. V. Crossing, Inter. Ry. Co.	10	2
317.	P., Ft. W. & C. Crossing, Ind. Har.	24	4
323.	Adds. Ridsley, C. & A.	..	..
325.	Mittineague, C. N. E. Ry.	..	..
	Contracts for Which Material Has Been Shipped.		
260.	Milstadt Junction, St. L. V.	14	2
269.	Berlin Heights, S. & I. E. R. R.	5	1
282.	Fifty-third St., N. Y. City, Grand Central.	19	5
285.	Guffey, B. & O.	17	3
295.	Glyndon, Great Northern.	17	3
298.	Helena, Great Northern.	17	7
301.	Sturgis, P. L. W. of P.	16	4
303.	Lostant, L. I. & I.	18	2
304.	Bemidji, Northern Pacific.	19	1
306.	Sauk Centre, Northern Pacific.	33	3
308.	Fergus Falls, Northern Pacific.	25	3
314.	Nelson, C. & N. W.	19	5
319.	Whitehouse, Pittsburgh E. & Nor.	13	3
	Contracts Upon Which Work is Not Started.		
259.	Leo Rock, St. L. V.	14	2
275.	Newark, Ohio, P. L. W. of P.	81	15
296.	Casselton, Great Northern.	35	1
305.	Forest Home, C. T. T. Co.	32	8
315.	Fourth Ave., Louisville So. Ry.	32	0
316.	Maurice, Orange & N. W.	12	4
318.	Harlem River Div., Grand Central "D"	15	0
	Harlem River Div., Grand Central "A"	17	3
320.	Columbus, Kan., St. L. & S. F.	31	1
321.	Diamond Crossing, D. & H.	14	14
322.	Miners Mills, D. & H.	10	2
324.	Goble, Ore., Northern Pacific.	7	1
326.	Clarksburg, B. & O.	21	3
327.	Walkerton, B. & O.	43	9

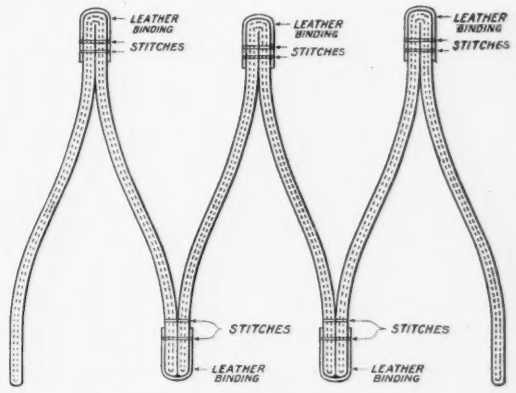
The Acme Vestibule Diaphragm.

The Acme vestibule diaphragm, shown in the accompanying engravings, is a new type brought out during the past year and intended to supersede the rubber diaphragm. It is made of cotton belting, being, therefore, without odor, and is guaranteed by the makers for five years. The Acme is made in types adjustable to Pullman, Gould, American Car & Foundry and other vestibules, and it is claimed that their life is double that of rubber, while the cost is about one-half.

The cotton belting of which these diaphragms are made is a tightly-woven, three-ply material. They are



Acme Vestibule Diaphragm, No. 2.



Acme Diaphragm, Pullman Type.

double-sewed on either edge with seven-strand Irish linen waxed thread, a lock-stitch being used, making the sewing as strong as the material. As will be seen from the section of the Pullman type of diaphragm shown the edges are bound with leather and the location of the double row of stitching is shown. The use of the leather binding for the edges not only gives additional stiffness to the structure, but also causes it to present a finished appearance. At the rounded corners at the top the margin between the stitching and the edge is increased. This increases the stiffness of the edge at these points, giving additional support, and preventing all sagging. The top is covered with a hood, which is riveted on and prevents the lodgment of sparks, rain or snow in the valleys.

These diaphragms are made in two styles known as No. 1 and No. 2. The latter differs from the former only in the substitution of a row of rivets the entire length of the sections for one of the sewed seams. The diaphragms are furnished dyed in any desired color or coated with any one of the well-known leather finishes on one or both sides as desired. These diaphragms are one of the specialties of G. S. Wood & Co., Chicago.

Passenger Elevators on the Central London Railway.

The writer recently had an interview with Mr. Granville C. Cuningham, M. Inst. C. E., the General Manager of the Central London Railway, as to the working of the station electric lifts which have been in service on the line since its opening in 1900. The experience is unique and will be of use to American engineers in connection with the city work now going on.

All of the 13 stations of the Central London are furnished with passenger lifts, the total number being 48. The number of lifts varies from five at some stations to three at others. There are none with fewer than three, and the capacity of the lifts differs in different places. At the Bank terminal station, they are much larger than in other places because of the heavy traffic that has to be handled there. At the Shepherd's Bush station (the other end of the line) only three lifts are installed, but four more are now being added. These new lifts are to be worked by hydraulic power, and are being built by the well-known English firm of Waygood & Co., Limited. Their object is to serve the large amount of passenger traffic on holidays and Sundays, and to deal with the usual morning and evening rush.

The height of the electric lifts (Sprague) varies from 45 ft. to 75 ft., i.e., the height the lift actually travels. They are worked at a speed of 3 ft. per second. This is the speed set on the motors and it cannot be exceeded.

The number of passengers dealt with in a day in the trains is on the average 135,000. This means, of course, that twice this number travel in the lifts, being taken down at one station and up at another. It is specially notable that the stairways are scarcely used at all except at such points as Shepherd's Bush. There, when a great crowd of "in" and "out" passengers assembles, it is often impossible to deal with them all both ways. The passengers wishing to entrain are taken down in the lifts, while those who leave the trains at this terminal station are requested to take the stairway up. When the new hydraulic lifts are in position this will be remedied, but at the present moment, with this exception, practically speaking, the electric lifts carry the entire traffic.

Th question naturally arises as to why the Central London is not extending the *electric* lift idea for its four new conveyances at Shepherd's Bush. We are unable to say much on this point at present, though it will necessarily lead to a great deal of conjecture on the part of engineers both in England and America, especially in view of the fact that the only other tube railroad of any dimensions now working is now running electric lifts, having grown dissatisfied with the original hydraulic ones. We may also mention that the Great Northern & City Railway, which, owing to delays, will not now be opened until about the end of the year, is also installing electric lifts made by an English firm, Gaston & Co., Limited, of Erith, at all stations.

It is asserted, however, authoritatively that the Central London electric lifts have worked very satisfactorily, though there is this objection to them, viz., when the current is cut off the lift is stuck, and in order to overcome this difficulty or objection Mr. Cuningham's staff are putting in an independent current to work the lifts so that they may have—when one system of current breaks down—another to rely upon. The advantage of the hydraulic lift is that if the power breaks down, the lift can always be let down by running the water off, and thus the passengers can be released.

The cost of operation is about one-tenth of the cost of operating the whole system, and it works out at about 10 passengers per penny up and down, or practically 20 passenger journeys.

With regard to delays, there have been very few—in fact, none at all due to the lifts. The disturbances which have occurred have arisen from the current going off unexpectedly, thus stopping the lift. But such disturbances have been very rare, and no important results have followed therefrom. No passengers have been injured except when boys have stuck their feet through the grill gate and got them caught in the top step. That has happened once or twice, but apart from these occurrences there have been no accidents due to the working of the lifts.

The management of this railroad is just about to change over from the locomotive to the motor-car (multiple unit) system. This, it is pretty well known, is with a view to getting rid of the noise and vibration caused by the heavy locomotives, but there are other advantages as well to accrue from the conversion, for the company will be able to reverse its trains far more quickly, and consequently give a more rapid service than is obtained at present. At present there is a 2½ minute service. That is the best that can be done with the existing system, at busiest hours. The trains are consequently much overcrowded at times, and there is some public grumbling of course. When the motor-car trains are running, a two minute service will be given, and this will allow of a greater carrying capacity of 25 per cent. We learn that the Central London has no claims for compensation under the head of vibration troubles, though this contingency is provided for in the last balance sheet.

A. B.

LONDON, Aug. 29.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

CONTRIBUTIONS—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussion of subjects pertaining to ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

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Locomotive Building in the United States.

August 22 the Director of the Census issued Bulletin No. 243, which is devoted to the manufacture of locomotives in the United States. According to this bulletin we built in the year 1900 a total of 3,046 locomotives. Of these 2,831 were steam locomotives, 55 compressed air, 155 electric and 5 gas locomotives. Besides these there were upwards of 6,000 traction engines and more than 4,000 motor vehicles built. The total value of all this product is given at 42 million dollars. The locomotives were valued at $29,988,583, or an average of $10,590 each. These figures were gathered from 28 establishments devoted especially to locomotive building, at which works 2,774 locomotives of all classes were built, with an aggregate value of $27,121,063, or $9,777 each. But beyond this product, 272 locomotives were built at 26 railroad shops. It will be observed that about nine per cent. of the total product of steam locomotives for the year was built at the railroad shops.

Of course, we are obliged to believe that the figures of the United States Census are more accurate than those collected by the *Railroad Gazette* almost two years ago; in December of 1900 (page 862) we published our own statistics of the locomotives built at the contracting works. We found these to number 3,153 locomotives built at 15 works. The United States Census, it will be observed, has 2,774 locomotives of all classes built at 28 works. We can see no explanation of this difference of 379 locomotives. Our figures included steam locomotives, compressed air locomotives, and electric locomotives, just as did the figures of the Census Bureau. Our figures were gathered directly from the builders and it is quite obvious that they did not come from as many builders as reported to the Census Bureau. In fact, they came from but little more than half as many. This illustrates some of the difficulties of making history. Our figures were very specific, the companies reporting quite carefully as to various details of the product, and even now we are inclined to believe that there is some mistake in the compilation of the Census figures. At any rate, there is still an opportunity to go over the figures before they are published in permanent form.

In 1890, 2,409 locomotives were built by the contracting works, with an average value of $8,199. In 1900, 2,774 locomotives built at the locomotive works had an average value of $9,777, the increase being 19.2 per cent. We suppose that the greatest part of this increase is due to the greater weight of the engines. The average weight of engines built in 1890, at one important establishment was 92,000 lbs., exclusive of the tender. In 1900 the average weight of the engines built at the same works was 129,000 lbs., an increase of 40.2 per cent. It is not supposable that this increase would have held all through the product of all the shops, but surely it is sufficient to account for a great increase in price. It must be remembered that these figures are for the year 1900, and that since that time a number of very heavy engines have been built.

The statistics of the manufacture of traction engines are rather surprising to one who has never had occasion to think particularly of that matter. The total number built in 1900 was 6,132, and their value was $6,388,000. The greatest number was built in Ohio and the next greatest in Michigan, these two States having built about 45 per cent. of the total product. The statistics of motor vehicles are not of particular value, for the reason that in the year and eight months since elapsed this branch of industry has expanded enormously. Yet, in 1900, there were built in the United States 4,192 motor vehicles, of which 1,681 were steam carriages, 1,575 electric vehicles and 436 hydro-carbon motors. This division of the subject includes all self-propelling carriages, wagons and trucks, and probably it will surprise most of our readers, as it does us, to find how small a percentage use some type of hydro-carbon motor.

The President to the Railroad Firemen.

The speech of President Roosevelt before the Brotherhood of Locomotive Firemen at Chattanooga last Monday was in admirable taste, and characteristic of the man. He made the journey from Washington almost entirely for the purpose of attending the convention, and he testified to his friendship for the railroad men and his admiration of their ability, skill and fidelity in words which were sincere and direct as well as warm hearted; yet he did not yield to the politician's temptation to begin and end with mere friendly platitudes. He believed in organized labor and praised the good work of the firemen's brotherhood, yet plainly told them that only with men of strong individual character could any leader or set of leaders ever make a strong brotherhood. "The man who counts in the Brotherhood is the man that pulls his own weight and a little more. Much can be done by the brotherhood, but it still remains true in the brotherhood and everywhere else throughout American life that in the last resort nothing can supply the place of a man's own individual qualities."

If there was present among the members any mere agitator, or one who expects to make advancement merely by numbers he was rebuked rather than encouraged by the President's utterances. The doctrine of the importance of the individual, when interpreted, means, to the labor-unionist, that a brotherhood should level men up, not level them down; that the truly successful leader is not he who gets the best wages for the poorest men, but he who encourages the poorer workmen to become better ones, and thus to compel better wages.

Mr. Roosevelt's address should be an inspiration to every leader of intelligent and skilled "labor," for the leader who devotes his energies to the elevation of his fellow members, to showing them how to be more skillful and faithful and therefore more valuable to their employers and better fortified in whatever demands they may have to make, will find himself doing good all of the time, instead of only at those rare times when a grievance can be formulated.

The apparently incurable bane of labor unionism in America has been that the leader could only be sure of the support of his constituents when he was doing something; which meant asking something of the employer. When there was no immediate need of asking for anything, the leader felt less confidence in the permanence of his job, which tempted him to manufacture grievances. President Roosevelt has suggested an antidote for this unhappy condition of things.*

Annual Reports.

Southern Railway.—The publication of the annual report of this company for the year ended June 30 last comes at a time when Wall Street is interested in a struggle for control of the company. It is supposed in the Street that heavy purchases of the stock of the company in the open markets have been by interests not now in the management of the property, who have expected that with the expiration of the voting trust next October they would be enabled to hereafter control the management of the property. Whatever actual basis there may be for this theory of an attempt at wresting the management of the company from the present interests, the action of the directors two weeks ago in deferring the semi-annual dividend announcement is taken as giving some color to the assertions.

The Southern Railway, as is well known, is a reorganization of the old Richmond Terminal system, the organization of the present company dating from 1894. The stocks of the new company were to be held in a voting trust to continue for five years or until such period thereafter as a 5 per cent. dividend had been declared and paid on the preferred stock. The five year period expired in 1899, but then the preferred stock had paid only 1 per cent. annual dividend, though the rate was later in 1899 advanced so that 2 per cent. was paid out of the earnings for that fiscal year. Other advances in the rate were subsequently made, and in April last year the semi-annual dividend was raised to 2½ per cent., so that with the dividend usually declared in this month and payable in October declared at the same rate, 5 per cent. would have been paid in the year on the preferred stock and the voting trust would have been dissolved. Instead, however, the directors "deferred" declaration of any dividend, saying that they acted by request of holders of large amounts of both classes of stocks in order that the opinion of the general body of shareholders might be obtained as to a continuance of the voting trust for another period of five years. What reason the directors may have for believing that the stock has been heavily purchased by other interests desiring to change the management of the company is not apparent and no well defined theories are held in Wall Street as to the identity of any such purchasers.

With the Reading Railroad, where the reduction in the dividend on the first preferred shares keeps alive the voting trust for two years longer at least, it is supposed that the Pennsylvania Railroad has been a very heavy purchaser of the stock and that possibly the Vanderbilt interests have been acting with them or independently to secure control of that property.

Whatever may be the outcome in the control of the Southern Railway there is no question of the prosperity which the company has had in each year since the reorganization. The property is on a substantial basis, with a heavy business as compared with the operations of a few years ago, and its finances are in a satisfactory condition. In the past year the gross revenues increased by $3,051,766, but net income from operation gained by only $548,554, and the surplus available for the preferred stock was only $60,397 higher than in 1901; the exact amount being $3,600,897, virtually 6 per cent. on the preferred shares. On account of the action of the directors in regard to the dividend payable in October, only one dividend payment (in April of 2½ per cent.) was declared out of the earnings of 1902 as against 4 per cent. in 1901, so that the surplus over dividends was $2,100,897 in 1902 as against $1,140,500 in the previous year. These gross earnings were on 6,744 miles, an increase of 132 miles in the average length of road worked, but at the end of the fiscal year the company operated 6,766 miles, or only 37 miles more road than at the close of the previous fiscal year, the St. Louis division being operated for only six months in 1901. The figures of the income account for the last two years are, as follows:

	1902.	1901.	Increase.
Gross earnings	$37,712,248	$34,660,482	$3,051,766
Operating exp. and taxes	26,846,837	24,343,625	2,503,212
Net earnings	$10,865,411	$10,316,857	$548,554
Net income	11,689,920	10,815,563	874,357
Interest and rentals	7,833,614	7,181,296	652,318
Other charges	255,409	93,767	161,642
Surplus	$3,600,897	$3,540,500	$60,397
Pref. dividends	*1,500,000	‡2,400,000	§900,000
Bal to profit and loss	$2,100,897	$1,140,500	$960,397

*2½ per cent. ‡4 per cent. §Decrease.

A comparison of earnings and expenses for these two years on substantially the same properties, shows an increase of $2,014,476, or 5⅔ per cent. in gross receipts: an increase of $1,753,423, or 7 per cent., in expenses, leaving an addition of but $261,053, or less than 2½ per cent. in net earnings. None of these figures include the operations of the Mobile & Ohio—now controlled by the Southern Railway but independently operated—nor do they include the earnings of the Cincinnati Southern and other affiliated properties of the Southern Railway not directly operated.

Charges for new equipment have been over $2,000,000 in each of the last three fiscal years. Outstanding equipment obligations of the Southern Railway Company cover about 10,325 freight cars, 98 passenger cars, and 118 locomotives. The contract price of trust equipment has been $9,683,800, of which $4,632,950 has been paid, leaving $5,050,875 as the unmatured contract price now carried in equipment trusts. The equipment bought by the equipment notes issued last year includes 10 passenger locomotives, 25 freight locomotives, and 3,375 freight cars. Other new equipment charged to capital account included 12 passenger cars, 531 freight cars and one car float costing $414,182. The freight and passenger equipment has been not far from doubled since 1895. Following is a comparison of the equipment owned in that year and on June 30 last.

	1902.	1895.	Increase
Box cars	16,432	9,555	6,877
Coal cars	12,658	6,521	6,137
Total standard gage freight cars.	34,554	18,838	15,716
Narrow gage cars	130	86	44
Passenger cars	800	487	313
Passenger locomotives	252	166	86
Freight locomotives	582	397	185
Total locomotives	915	623	292

In the last four fiscal years the company has bought or built 156 new locomotives, 11,688 new freight cars, and 139 passenger cars, exclusive of such equipment as has been taken over with acquired properties.

The increased cost of moving traffic in 1902 absorbed

*Extacts from President Roosevelt's address at Chattanooga will be found on another page.

considerably more than half the total reported increase in operating charges. The increase in the year was $1,141,000, or 9⅞ per cent. President Spencer notes that "this increase was due principally to increased traffic necessitating additional engine and train service, increased cost and consumption of coal and other supplies, insufficiency of motive power and terminals to properly and promptly handle the increased traffic, and to serious interruptions to the movement of traffic caused by storms and floods."

Among the principal increases were:

		Per cent.
Enginemen, firemen and roundhousemen	$204,663.80	9.66
Fuel for locomotives	273,819.69	12.71
Train service	142,229.59	10.31
Yardmen and watchmen	77,297.34	12.92
Station service	108,587.00	8.01
Loss and damage to freight and baggage	53,301.49	24.76

"The increase was out of proportion as compared with the increase in revenue, or with the amount of work performed, and it is hoped, with improved facilities and service, the ratios can be materially reduced."

In view of the interest concerning the company's future raised by the question of the possible termination of the voting trust or its extension, some figures may be submitted showing the changes in the company's earning power, mileage, capital accounts and traffic, between 1895 and the present year. It may be pointed out that the increase of 2,375 miles of operated road shown in this period, besides enabling the company to connect many of its former divisions and to better serve the local traffic along its lines, has also given it lines into St. Louis, Mobile, Memphis, Charleston and Savannah, as well as trackage rights from the latter point to Jacksonville.

Changes in capital account are shown in the following summary.

	1902.	1895.	Increase.
Total bonds, etc.	$161,869,638	$99,654,405	$62,215,233
Mobile & Ohio stock certificates	4,932,600	.....	4,932,600
Preferred stock	60,000,000	50,000,000	10,000,000
Common stock	120,000,000	120,000.000	.....
Total capital liabilities	$346,802,238	$269,654,405	$77,147,833

As against this outstanding capital, the company owns, besides its road, equipment and other property, in use, and securities pledged or held for control, $1,535,000 par value of its own bonds, and $1,795,200 value of securities held as free assets in the treasury. The changes in the operated mileage in this period are shown below:

	1902.	1899.	1895.	1902 over 1895.
Miles owned	4,365	3,579	2,842	1,523
Miles leased	818	1,123	968	*50
Miles operated under agreements	10	249	279	*269
Miles controlled	1,268	746	253	1,015
Miles trackage	305	262	49	256
Total miles	6,766	5,959	4,391	2,375

*Decrease.

This mileage, which is that reported for June 30 of each year, includes the lines now operated, by the company's organization, but not such properties as the Mobile & Ohio, separately operated. The traffic movement in each of the last two years, and in 1895, is compared below:

	1902.	1895.
Tons moved	16,811,540	6,675,750
Tons one mile	2,678,309,000	1,098,933,000
Passengers moved	8,611,070	3,427,860
Passengers one mile	427,841,247	178,015,925
Freight train miles	13,713,090	7,483,840
Passenger train miles	11,736,345	5,630,270
Loaded freight car miles	197,612,060	98,419,740
Empty freight car miles	70,822,470	40,523,370
Freight train load	195	147
Ton-mile revenue (mills)	9.31	9.84
Earnings per freight train mile	$1.819	$1.445

The development reported yearly in earning capacity is brought out by the following figures:

	Miles worked.	Gross earnings.	Net earnings.	Surplus.
1902	6,744	$37,712,248	$10,865,411	$3,600,897
1901	6,612	34,660,482	10,316,857	3,540,500
1900	6,306	31,200,870	9,369,423	2,917,252
1899	5,378	25,353,686	7,997,331	2,094,519
1898	4,937	21,095,839	6,593,974	1,007,013
1897	4,806	19,079,500	5,846,344	445,920
1896	4,574	19,082,247	5,630,799	556,478
1895	4,392	17,114,792	5,051,937	895,745
Increase	2,352	$20,597,456	$5,813,474	$2,705,152

Freight and passenger earnings, gross receipts and net earnings *per mile of road* are shown below, the figures being taken from the annual reports:

	Freight earnings.	Pass. earnings.	Total gross.	Net earnings
1902	$3,699	$1,814	$5,592	$1,611
1901	3,473	1,696	5,250	1,560
1900	3,314	1,556	4,870	1,479
1899	3,027	1,690	4,764	1,506
1898	2,785	1,452	4,265	1,323
1897	2,578	1,357	3,970	1,217
1896	2,636	1,465	4,172	1,231
1895	2,613	1,349	4,735	1,221

Any discrepancies of these figures with earlier figures of operated mileage and aggregate receipts is accounted for by the changes made in different reports to give comparisons on as nearly the same operated lines, as was feasible.

Norfolk & Western.—The report for the year to June 30 last, now at hand, is the sixth issued by the reorganized company and the third issued since the property has been controlled by the Pennsylvania Railroad interests, though the past year is only the second during which those interests have been in complete dominance in the company's affairs. In the second annual report, that for 1898, the new company having been in control for only nine months. the directors pointed out that the earnings then reported "both gross and net, exceeded those of any previous year in the company's history." Since then there have been steady increases yearly, and with only 112 miles of added road, of relatively light earning power, the gross receipts have risen to $17,552,000 in 1902, while the net earnings now reported are nearly one and one-fourth times as large as in 1898, aggregating $7,416,000. The increases in gross and net, for each year, are shown below:

	Increase in gross earnings.	Per ct.	Increase in net earnings.	Per ct.
1902	$1,373,136	8½	$1,022,665	16
1901	1,694,437	12	750,074	13.4
1900	2,263,865	22	1,701,873	44
1899	591,017	5	538,012	16
1898	698,400	6⅔	715,752	27⅛

This growth in earning capacity may be further shown in the following comparison of earnings per mile:

	1902.	1898.	Increase.
Gross earnings	$10,466	$7,180	$3,286
Net earnings	4,422	2,141	2,281

The chief contributing factor in this enhancement of gross receipts has been the enlarging demand for soft coal, which in 1902 contributed about 60 per cent. of the tons moved. The increases in gross receipts in the last few years are partly due to the better average rates on soft coal. The Norfolk & Western's average ton mile rate, on all freight, which had been 4.46 mills, in 1897, had fallen to 3.97 mills in 1899, and in 1900, it was stated that the rates on the tidewater movement of coal were the lowest ever received. In 1902 the average ton-mile rate was 4.63 mills, against 4.66 mills in 1901, but this falling off in the average rate seems attributable to working the Cincinnati, Portsmouth & Virginia, taken over late in 1901. The relative effect of increasing freight traffic movement and the changes in the rate situation, on the yearly gains in earnings, may be examined in the following figures, showing the yearly gains in freight receipts and in ton-mileage, with the percentages of enhancement.

	Increased freight earnings.	Per ct.	Increased ton-miles.	Per ct.
1902	$1,089,162	8.06	254,717,300	9
1901	1,461,101	12.00	131,834,134	4.8
1900	2,003,968	21.00	276,439,730	11.3
1899	442,195	5.00	154,784,150	7.0
1898	611,266	7.03	351,862,260	18.0

This growth of traffic and of rates, together with remarkable success in handling economically the operating problem of moving the growing tonnage has enabled the company to make satisfactory exhibits of profits in each year. The company paid 2 per cent. on the common stock, in dividends, and out of the remaining surplus the directors appropriated $2,500,000 for betterments, $1,500,000 having been so appropriated in each of the two preceding years. This showing of increased profits for the year resulted from increase of 924,036 tons, or 8.15 per cent. in freight traffic, and of 254,717,000, or 9 per cent. in ton-miles, with a gain of 9.86 per cent. in number of passengers moved, and of 12.8 per cent. in passenger miles made, this larger business being moved with increase of only 70,707 passenger train miles, and increase of only 222,300 freight train miles. The details of the income account for the last two years, and the figures for 1898, the first complete fiscal year of the present company, are compiled below:

	1902.	1901.	1898.
Average miles	1,677	1,660	1,565
Pass. earnings	$2,379,476	$2,134,590	$1,467,533
Freight earnings	14,594,281	13,505,118	9,306,899
Gross earnings	17,552,205	16,179,069	11,236,123
Per cent. exp. to gross	55.17	57.89	67.17
Operating exp. and taxes.	10,136,228	9,785,757	7,886,099
Net earnings	$7,415,977	$6,393,312	$3,350,024
P. c. exp. & taxes to gross	57.75	60.48	70.18
Net income	7,490,872	6,461,929	3,382,987
Charges	2,367,777	2,268,051	2,239,434
Balance	$5,123,095	$4,193,878	$1,143,554
Dividends	2,199,398	1,554,616	.....
Surplus	$2,923,697	$2,639,262	$1,143,534

Examining the expense account in detail, the following comparative figures for 1902, 1901 and 1898, may be given:

	1902.	1901.	1898.	1902 over 1898.
Main. way	$2,131,048	$2,104,887	$1,542,978	$588,070
Main. equip.	2,334,586	2,363,935	1,727,899	606,687
Cond'ct. transp.	4,853,109	4,556,737	3,974,472	878,637
Gen. exp. & tax	817,484	760,198	640,750	176,734
	$10,136,227	$9,785,757	$7,886,099	$2,250,128

Thus, maintenance charges have absorbed $1,194,757, or over half the total expansion in expenses in this period. They have been kept at about 25 per cent. of the gross receipts in all these years, and in 1902 about $1,200 per mile of road was charged for maintenance of way. The special betterment appropriation of $2,500,000 is itself equal to over $1,500 per mile of operated road, and about 14 per cent. of gross receipts. The changes in the traffic movement in the same period are shown below:

	1902.	1901.	1898.
Miles operated	1,677	1,660	1,565
No. tons freight	$12,268,100	$11,344,064	$8,276,948
No. passengers	2,630,615	2,394,445	1,684,851
Tons one mile*	3,151,912	2,897,195	2,301,313
Passengers one mile	101,275,087	89,787,184	66,797,454
Passenger train miles	2,442,552	2,371,545	2,111,989
Freight train miles	6,625,432	6,403,115	6,483,290
Rev. frt. tr'n load (tons)	476	452	355
Av. frt. tr'n haul (miles)	257	255	278
Freight train mile rev.	$2.20	$2.11	$1.45
Pass. train mile rev.	$1.15	$1.08	$.868
Av. ton-mile rate (mills)	4.63	4.66	4.09
Av. pass. mile rate (cts.)	2.350	2.377	2.743

*000 omitted.

As the larger share of the company's traffic originates from soft coal, so the preponderating properties of soft coal is mined in and hauled from the Pocahontas fields. In the past year options on the best producing mines in this field were secured by a syndicate, including prominent interests in the steel company consolidations, who threatened to divert the tonnage thus controlled from the Norfolk & Western by building various branch lines to other railroads. To prevent the loss of this tonnage, the Norfolk & Western bought the stock of the new company, organized to control these fields, and became joint guarantor, with the new coal company, on $22,000,000 bonds, issued to pay for the coal land options. In the past year the N. & W. advanced certain funds to meet a deficit of the Pocahontas Coal & Coke Co., in meeting the interest on these bonds. It is believed, however, that under contracts made with the United States Steel Co., and others, the royalties will be sufficient hereafter to meet the interest.

A very large share of the development work planned by the railroad company for the coming year is to provide new branch line connections, equipment and other additional facilities, as well as reduction of grades on its main line to the coal fields, in order to handle more satisfactory the larger tonnage anticipated from the Pocahontas fields.

Canadian Pacific Railway.—The period covered by the annual report now at hand to June 30 last, was one of exceptional prosperity, the operations of the year showing an increase of $6,647,550 in gross receipts, or 21½ per cent., with $1,976,538 of this appearing as enhanced net earnings. The surplus income for the year was $3,063,075 after deduction of $150,000 applied against cost of steamships and the payment of 4 per cent. on the preferred stock and 5 per cent. on the common stock, the same dividends as were paid in the previous fiscal year. The income results of the year are briefly summarized below in comparison with the figures for 1901:

	1902.	1901.	Increase.
Passenger earnings	$9,359,522	$8,083,370	$1,276,152
Freight earnings	24,199,428	18,983,186	5,216,242
Total earnings	37,503,054	30,855,204	6,647,850
Operating expenses	23,417,141	18,745,828	4,671,313
Net earnings	$14,085,913	$12,109,376	$1,976,537
Total net income	15,044,739	13,042,801	2,001,938
Fixed charges	7,334,825	7,305,835	28,990
Balance	$7,709,914	$5,736,966	$1,972,948
Dividends	4,496,840	4,472,506	24,334
Surplus	$3,213,074	$1,264,460	$1,948,614
For steamship depreciation	$150,000	$150,000	.....

These figures of revenue are on the operation of 7,588 miles, an increase of only 25 miles over the 1901 figures. But besides this mileage the Canadian Pacific Railway line included on June 30, 735 miles of road worked under various agreements, and 324 miles under construction, or a total of 8,647 miles. In addition, the company owns the majority of the voting securities of the Minneapolis, St. Paul & Sault Ste. Marie Railway, 1,412 miles; and of the Duluth, South Shore & Atlantic, 565 miles; so that the rail lines controlled by the Canadian Pacific Railway amount to 10,624 miles.

The difference between the net operating earnings and the total net income for 1902 shown in the figures above, $958,827, is principally accounted for by interest received from the Duluth, South Shore & Atlantic and the Minneapolis, St. Paul & Sault Ste. Marie Railways, both properties being long controlled by the Canadian Pacific through ownership of the majority of the outstanding capital stock, the company holding as well a very heavy interest in the bond issues of the two companies, guaranteeing their interest charges. This guarantee was a considerable charge on the Canadian Pacific's revenues during the past years of depressed business, but these properties are now showing very heavy increases in revenues. The current annual report suggests that the Sault Ste. Marie Company will shortly be placed on a dividend basis.

The Canadian Pacific Railway does not give a great amount of information in its yearly reports, and in that now at hand less than four pages are occupied with the remarks of President Shaughnessy. There is practically no account of the significant and even radical changes which took place during the past year in the company's traffic and revenues and in the improvement work carried on, beyond what may be gleaned from examination of such statistics as are published in the report, very few of these being given with any comparisons for previous years.

If the company's management does not discuss the traffic changes which brought about the great expansion of revenues in the past year, the leading cause for this is apparent enough in the heavy out-turn of the wheat harvest in the northwest section of the United States, a large portion of which the Canadian Pacific hauls for export; as well as in the large harvests gathered along its own lines, and particularly in Manitoba. The enormous yields of grain in the company's territory had the natural effect of attracting a great immigration within the past 12 months, which was encouraged by the company itself; and this has been followed by a noteworthy local development and as well by very heavy receipts to the company from sales of its land grants, the sales in the past year running up to $5,133,000.

The company carried in the fiscal year now reported on 52,720,000 bushels of grain, which was an increase of 19,792,000 bushels over the amount moved in the previous year, or 60 per cent. The flour traffic also increased heavily, 4,922,000 barrels being received by the company for transportation. The growth of traffic as measured by ton miles is great, the expansion last year over 1901 having been 864 million ton-miles, an increase of one-third.

These figures of heavily enlarged traffic have added interest because of the increased economy with which the company was able to move its freight to market, a result attributable in part no doubt to the class of tonnage, facilitating economical movement. But large additions in recent years of heavy equipment, the improve-

ment of the physical condition of the property, and additions in other facilities, with good use of all these available facilities, must be held to have chiefly contributed to the transportation results shown, the increase in freight train mileage being only 2,413,000 miles, or about 23 per cent., as against the 33 per cent. increase in ton miles. Thus, despite the lowering of the average ton-mile rate, the company was enabled to increase its average receipts per freight train mile by 6 cents to a total of $1.83.

The company used a very heavy proportion, if not the largest proportion, of the higher receipts for the year for the improvement of its property. The reported increase in charges after conducting transportation ($886,000) is notably small, and even allowing for a part of the $1,641,000 reported increase of motive power expenses as representing cost of moving the additional traffic, it is apparent that the company's transportation operations of the past year were marked by very considerable economies. In addition to the larger charges directly to operating expenses, for improvements, etc., the company still charged certain classes of this work against capital account. For improvements and additions on the main lines these charges were $1,917,-300, and for improvements of the leased lines $735,235.

These charges, however, include only a small proportion of the resources at the command of the company during the past year. A table in the report summarizes the total resources on both income and capital account for 1902, giving also the expenditures under different headings, without, however, accounting for the proportion chargeable against capital or against surplus income. This table shows total cash resources in the year of $30,168,000, of which $1,710,000 was the surplus revenue; $9,793,000 cash on hand at the beginning of the fiscal year, and the balance was from receipts in the issue of new capital and from sales of lands, as shown by the figures below:

Resources:	
Surplus revenues, 1902	$7,709,914
Land Department sales	1,569,901
Government bonuses	30,098
Subscriptions on $19,500,000 new capital stock	7,624,162
Sale of $610,000 debenture stock	3,431,529
Total cash receipts, 1902	$20,374,604
Add cash on hand June 30, 1901	9,793,463
Total cash resources	$30,168,067
Accounted for as follows:	
4 per cent. preference stock dividends	$1,246,840
5 per cent. ordinary stock dividends	3,250,000
Increase in accounts receivable	491,593
New mileage and improvements	2,496,209
Hotels, buildings, etc.	334,031
Rolling stock, shops and machinery	2,214,824
New Montreal shops	445,682
Land grant bonds retired	1,941,400
New lake steamer	22,484
Securities acquired by sale of debenture stock	2,964,832
Increase in current liabilities	26,480
Cash on hand June 30, 1902	15,227,691
Total accounted for	$30,168,067

The subscription of $7,624,000 noted above is the first installment on an issue of $19,500,000 new stock offered to the shareholders at par, although the present report merely refers to the order of the Dominion government granting the necessary legal authority for the issue and to the resolution of the shareholders for particulars of the expenditures of the proceeds. President Shaughnessy states that this season 480 miles of 80-lb. rail are being laid on the main line, and that the directors hope to have the lighter rails replaced on all the main lines before the end of 1904. He refers to extensions of about 150 miles in Manitoba now under way; an extension of 22 miles in Quebec, and the purchase of certain short lines near Ottawa and Montreal 150 miles, altogether, to improve the company's position in this territory and to facilitate the ultimate shortening of the line between Montreal and Pembroke. Mr. Shaughnessy also states that the shareholders will be asked to sanction a change in the by-laws to classify the Board of Directors instead of electing the whole Board annually as heretofore.

Chicago Great Western.—This company's report for the year ended June 30, 1902, lacks the "general remarks" by President A. B. Stickney, which have so long been an entertaining feature of these reports. That Mr. Stickney has not forgotten how to interest, not to say stir up his competitors, his recent contract with the packing houses amply demonstrates. That he is still a good hand at dialectics his recent circular to his shareholders sufficiently proves, but of all this there is nothing in the present report. The text of the report hardly takes up three pages, but within this space Mr. Stickney makes a statement of the conditions under which the western railroads were operated in the past fiscal year, because of the shortage in the corn harvest of 1900 and other determining circumstances in the movement of traffic. First, is income account, showing increase of revenues, and substantial prosperity, the figures following:

	1902.	1901.	Increase.
Miles operated	929.51	929.51	.....
Gross receipts, all sources	$7,549,688	$7,013,861	$535,826
Operating expenses	5,284,690	4,831,515	453,174
Balance	$2,264,998	$2,182,346	$82,652
Taxes	204,767	204,000	767
Net earnings	$2,060,230	$1,978,346	$81,884
Gross earnings per mile	8,122	7,545	576
Operating expenses per mile	5,685	5,197	487
Taxes per mile	220	219	.....
Net earnings per mile	2,216	2,128	88

This summary Mr. Stickney follows with a table showing the results in each six months of the fiscal year, and points out that in every item of the table there was an increase in the first six months, except distance hauled, and a decrease in every item in the second six months except in average rates.

The ton-miles hauled during the last two years, divided into six months' periods, were:

In the six months ending with December, 1900	426,000,000
In the six months ending with June, 1901	407,000,000
In the six months ending with December, 1901	465,000,000
In the six months ending with June, 1902	340,000,000

"The largest tonnage in any one month was 90,598,-000 ton-miles in October, 1901, and the smallest was 41,864,000 ton-miles in June, 1902. These extraordinary fluctuations in the tonnage, which are by no means conducive to economical operation, reflect the indirect and direct influence of the shortage in the corn crop of 1901. Its indirect influence forced an abnormal marketing of live stock in the first six months which increased the tonnage and left a shortage of live stock to be shipped in the next six months. The direct influence was, very little corn to be shipped during corn shipping months, which are always the six months following December, because it requires dry frosty weather to cure it so as to make corn fit for transportation."

In March last, issue of $2,700,000 debenture stock was authorized to pay the cost of reduction of grades, permanent bridges, side tracks, ballasting and miscellaneous additions and improvements which should be commenced in 1902, and to pay the cost of 40 locomotives, 16 coaches, 100 refrigerator and other rolling stock, while the surplus is held available for similar capital expenditures in the succeeding years.

Total capital charges in the year were $2,063,485, of which equipment purchases, 24 locomotives, 16 box cars, four chair cars, and other equipment account for $464,-819. Expenditures for additional terminals and improvements were $1,598,666.

New York, Ontario & Western.—This company is the first of the anthracite roads to report for the year ended June 30, which covered 1½ months of the strike, mining having been suspended since May 2. With coal revenues accounting for 60 per cent. of the company's total, loss of this business was found to affect the year's results most unfavorably, not only in loss of gross receipts, but even to a greater extent in loss of net. The stoppage of coal shipments makes operating statistics, for the years so affected, of little value for comparison. The comparative earnings for 1902 and 1901 follow:

	1902.	1901.	Changes.
Gross earnings	$5,456,696	$5,322,884	Inc. $133,812
Operating expenses	4,016,296	3,638,341	Inc. 377,955
Oper. exp. and taxes	4,157,754	3,777,137	Inc. 380,617
Net earnings	$1,298,942	$1,545,747	Dec. $247,805
Fixed charges	639,983	666,515	Dec. 26,532
Surplus	$658,959	$879,232	Dec. $220,273

Very few companies report the sources of their revenues in so detailed a form as the Ontario & Western, and though the total of its receipts is not very large, comparisons with earlier years would bring out interesting facts, but it can only be mentioned here, that, since 1898 the freight revenues have increased $1,287,000, of which coal has contributed $851,000; through freight, $174,000; local freight, $164,000, and the milk trains, $79,000.

In a report of a company, like this, managed by officers who are able to take broad views of industrial tendencies, certain facts and comments of general interest, not elsewhere met, are often found. In the present report, for instance, the coal strike, in its various aspects, is more directly handled than may be the case in the reports of the larger companies.

The General Manager, writing August 12, estimated a total reduction in production of anthracite coal to that date of 13,500,000 tons. This, with the reduction in output in February and March, caused by floods, will aggregate at least 15,000,000 tons, so far, during the year 1902. He further estimated that should the suspension of mining continue another month, as it has, the shortage will approximate 20 million tons. This enormous decrease in the output has caused such a shortage that it may be one and a half to two years before the output will be sufficient to more than supply the immediate and pressing demands of the market. Many of the mines in the Schuylkill region have been seriously damaged by flooding, and a number of miners have left the anthracite field, so it is quite probable that it will be several months after the strike is declared off before the maximum output can be produced."

One work of the past year has been the building of a branch from Ellenville, along part of the route of the abandoned Delaware & Hudson Canal, which is to be completed this year. An improvement of importance decided upon is the double-tracking of the main line from Cornwall, on the Hudson River, to Cadosia, the junction point with the Scranton Division, a distance of about 107 miles.

The report is very full in its statistics of operating details, and unusually so, in its tables, showing characteristics of roadway and particulars of equipment.

Per Diem on the Southern.

The Southern Railway, in the year ending on the 30th of last June, borrowed freight cars at 17.47 cents a day and lent them at 12.71 cents a day; and the borrowings exceeded the lendings to such an extent that the net balance against the company for the year was $34,-233. This we learn from the President's annual report, which has just been issued. The adverse balance does not mean that more cars were borrowed; nor does it mean more car days; but those cars which were borrowed were run more miles than the Southern's cars were run on foreign roads, and so, being paid for by the mile, the borrowed cars aggregated the greater cost. Southern cars away from home ran 97 million miles and about five million days (18.77 miles a day), while borrowed cars on the Southern's tracks ran 100 million miles and about four million days (25.26 miles a day).

With such a record as this the Southern, we should think, ought to be glad to try the per diem plan on almost any basis and with almost any rate—though it is by no means certain, of course, that the income from lent cars in 1902 will be as much larger, in proportion, than that for 1901, as 20 cents is larger than 12.71 cents. The borrowing roads may bestir themselves and run the cars more miles per day.

The report says nothing about the reason for the great difference between the two averages, though as the Southern has numerous long lines, while it must be constantly lending to many companies whose lines are all quite short, at least a part of the difference must be due to causes which are unavoidable; to the necessarily larger proportion of time spent by each car, on the short railroads, in standing to be loaded or unloaded.

The report presents a comparison showing that if the rate of 20 cents per diem had been in effect in 1901 and the same cars had moved the same number of miles in the same number of days, the balance would have been $242,666 in favor of the Southern, instead of $34,-233 against it. Whether this means an actual change, in the balance, of $276,899, can be learned only after we shall have the record of a year, or of several months at least, under the new system. If the foreign roads continue to run cars the low average of 18¾ miles a day we shall have to conclude that they are all extremely short roads—and shall have to comfort ourselves with the hope that they are collecting demurrage from consignees with a rigorous hand. They will need to collect the demurrage in any event, for their task is not merely to bring their average performance from 18¾ miles a day up to 25¼ miles; to get even with the Southern they will have to go above that figure; for the Southern will, no doubt, make a good increase in its own average. A road that runs borrowed cars a hundred million miles a year cannot afford to let wheels flatten on side tracks nowadays. Happily, this truth is now pretty generally appreciated, and we may expect to see a marked improvement in averages on both sides of the account; though the Southern, like all other roads, will find its saving, not in more rent money received, but in getting its cars back home for use in its own business.

The famous "Charles Dickens" of the London & North Western Railway completed its second million miles on Aug. 5. The engine has been in service for 20 years hauling passenger trains between London and Manchester. A total of 5,312 round trips between these two points, besides 186 other trips has been made. The engine was built at the Crewe Works and has, in its long service, been laid up for repairs but 12 per cent. of its time. Credit for this good record is, in a measure, due to the standardization methods employed by the builders which permit of rapid interchange of parts. Its average speed has steadily increased from 42 to 50⅓ miles an hour, and the weight of the train has likewise greatly increased. During its career, a total of 204,771 tons of water and 27,486 tons of coal have been consumed. One of the engine crew, Leigh Bowden, has been on this engine from the start; another one, Josiah Mills, since March, 1886. Eleven years ago we recorded the completion of the first million miles by "Charles Dickens."

NEW PUBLICATIONS.

Materials of Machines.—By Albert W. Smith, Professor of Mechanical Engineering, Leland Stanford University, California. New York: John Wiley & Sons. 1902. 12mo. $1.00.

The author of this book explains that it is an effort to bring together concisely the information necessary to him who has to select materials for machine parts. Following the opening chapters on the metallurgy of iron and steel, testing of materials and the physical properties of the principal materials of construction, is a chapter on selection of materials for different machine parts giving the reasons for the use of certain metals according to the nature of the stresses to which the parts are subjected. The statements are clear and concise, and while the subject matter is in a way elementary, information on each subject has been given which will aid the designer. The book contains 142 pages with 17 figures and an excellent index.

Diagrams for Telegraph Engineers. By Willis H. Jones. New York: J. B. Taltavall, the *Telegraph Age*, 253 Broadway. Price $1.50.

This is a hand-book of 260 pages, 4 in. x 7 in., containing a large number of diagrams and over 200 pages of information on all kinds of mechanical and electrical work done in an American telegraph office. The full title of the book is "Pocket Edition of Diagrams and Complete Information for Telegraph Engineers and Students"; and the book is bound in flexible leather. After brief introductory chapters, giving elementary information about magnetism, electricity, the dynamo and

electrical measurements, the author takes up the duplex, the quadruplex, repeaters, the Wheatstone instrument, battery and dynamo connections, etc., and describes each apparatus or function in detail. For example, the different arrangements of quadruplex instruments, and the Milliken, the Toye, the Weiny-Phillips, and other repeaters, are shown in two diagrams each, one giving the theoretical connections and the other the actual; or, in other words, one diagram for the student and one to use as a guide in connecting instruments. The practical work of line construction, the arrangement of switch boards, storage batteries, the phonoplex and the telephone are also treated, and even the wireless telegraph is touched upon. The author is one of the editors of the *Telegraph Age*, and the book contains a large amount of material which he has prepared for that paper during the past five years. He writes with clearness and simplicity, using no unnecessary technicalities. Mr. Barclay, of the Western Union, calls it the best book of the kind that he has seen, and Mr. F. W. Jones, of the Postal Company, praises it in equally strong language.

Industrial Conciliation. A report of the conference held under the auspices of the National Civic Federation, December, 1901. Octavo, 278 pages; index. New York: G. P. Putnam's Sons.

This volume is issued in the "Questions of the Day" series, and its nature is explained by the title page. Every intelligent citizen knows pretty well what took place at the conference held in New York last December. This is a correct report of the proceedings, copyrighted by the Secretary. The volume contains the names of officers and executive committee, the addresses of the various gentlemen who spoke at the conference, and papers read at the Chicago conference the year before. Doubtless, the volume will be convenient and useful to many who have occasion to study this matter.

Modern Iron Foundry Practice. Part I. By Geo. R. Bale, Assoc. M. Inst. C. E. 387 pages, 208 illustrations. London: The Technical Publishing Co. Price 5s.

It is said by the author, that this work has been prepared to meet the existing want of a manual of modern iron foundry practice. The present volume deals with foundry equipment, materials used, and processes followed. A second volume will include chapters on machine moulding, physical testing, shrinkage, foundry costs, etc.

The chapter on "The Cupola and Its Charge" is of general interest, as it includes a practical discussion of the chemistry of cast iron. The author has made himself familiar with the results of many experimenters upon this important phase of iron founding and together with his own experience, has compiled much useful information.

Other chapters take up the important details of English foundry practice, including chapters on chilled and malleable castings. An index of 12 pages concludes the volume.

TRADE CATALOGUES.

The Lunkenheimer Co., Cincinnati, Ohio, has just issued a revised edition for August, 1902, of its 1898 catalogue and price list. This company makes a full line of pressure valves of all sorts, lubricators, oil cups, gages and steam specialties, all of which are shown in their booklet. Numerous useful tables for calculation and reference are inserted throughout the book and a convenient index is provided.

The Economy Locomotive Sander Company, Baltimore, Md., have issued a little illustrated catalogue containing descriptions and detail drawings of their sander. This device has an adjustable receiving tube, thus making possible the use of different grades of sand.

The Union Switch & Signal Co., Swissvale, Pa., has issued "Section 5" of its 1902 catalogue. This section deals with station signals; including two-position and three-position semaphores, two-arm, four-arm, and other styles, used as train-order or telegraph block signals. As announced in these columns Aug. 8, the Union Company proposes to issue a series of catalogues describing different classes of its products; Section 1, which was then noticed, being devoted to mechanical interlocking machines. It is intended to issue a section each month, although, as before stated, the different sections will not be issued in the order of their numbers.

The Railroad Supply Co., Chicago, has just issued the fifth edition of its book, "Track." This book was first got out about a year and a half ago and its popularity among railroad men is indicated by the number of editions that have been necessary in this time. Many copies have been sent out at the request of railroad men. The first edition contained 96 pages. The present edition is almost double this, having 176 pages, and many tables have been added. The book is of a convenient size for the pocket and will be sent free on request.

Fog Signaling in England.

The *Engineer* (London) of August 15 contains an article on fog signaling, analyzing the causes of 10 accidents reported by the Board of Trade for the last quarter of 1901. These 10 accidents make up more than half of all the accidents investigated by the Board during that quarter. The author concludes that six of the accidents were due to imperfect management, and the four remaining ones, in which enginemen ran past signals, furnish the basis for his principal discussion. Discussing the difficulties encountered by the locomotive runner and the practice among fogmen of giving visual hand signals, the article says:

"The showing of a red or a green light to a driver by the fogman is another difficulty, but one of a different nature. It is one that has not always existed, but has cropped up of recent years. It is due in part to the number of signals to be "fogged" having increased so considerably. Also to the staff that act as fogmen not being available to the same extent as formerly. Not that the number of men is less—the contrary is the case—but railroad companies hesitate to allow their men to work the long hours they used to do, and will not employ them for such long stretches of duty without relief. Again, competition amongst the companies has grown so much that those men in the traffic department who act as fogmen cannot be so readily spared. Further, there is the question of higher rate of pay now given to the men, which in itself has helped to swell the cost of fog signaling. Lastly, there is the difficulty and the objection of calling upon a platelayer, who has put in 12 hours' work on the line, to go on duty again for another eight hours. Consequently the companies have had to consider how to reduce the expense incident to providing a staff to act as fogmen. A means to this end is to make one man attend to two signals, which can be done where, for instance, an up and a down signal are near each other. The man stands on the up side and "fogs" the up signal by hand in the usual way, and puts detonators on the down line for the down signal by means of a machine, the lever of which is on the up side. In all such cases a fogman is saved. Such machines are used by the London & North Western, the Great Western, the Midland, and the Lancashire & Yorkshire lines. The North Eastern, on the southern division, uses a fog-signal machine, by which detonators are put on the rail. This is worked by an independent lever in the locking frame. The Great Central also put down some automatic fog-signaling machines; the Great Northern had some semi-automatic in Yorkshire, whilst other companies are experimenting with one apparatus or another. In all cases then, where a machine is employed to act as fogman, no hand signal can, of course, be given, and this complicates the question considerably when the absence of a fog signal indicates a clear road. Here, then, is another problem for solution."

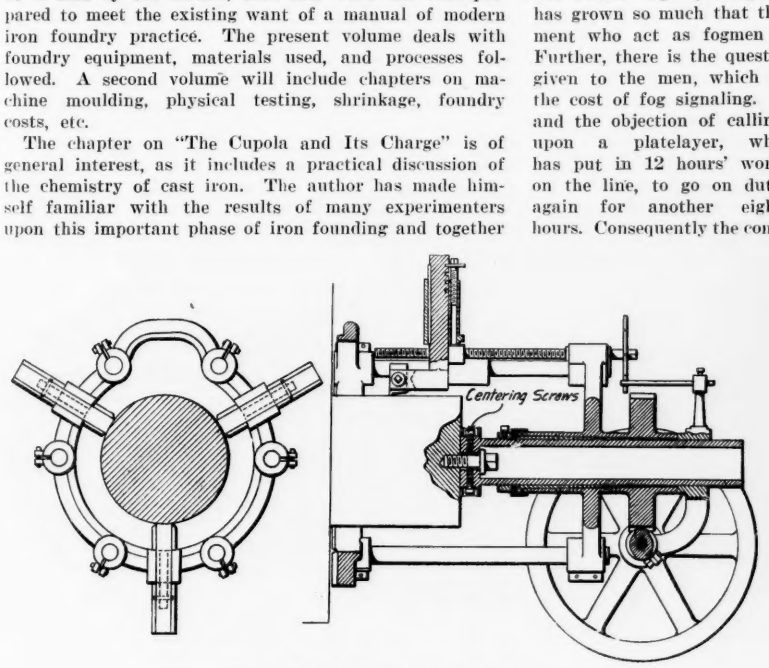
Reference is made to the innumerable patents for dealing with this difficulty by some device involving a special attachment on the locomotive, but it is held that these are presumably useless, for the railroads could have adopted the principle long ago, without the expense of patent royalties, as "obstruction signals" are now so old that there can be nothing patentable about the general idea. An efficient fog signaling system requires all engines to be fitted; this makes a difficulty when other companies send their engines over the lines. An important objection is the absence of an indication when the signal is clear. "If a signal is at danger and the obstruction fails to work so that the whistle is not blown, or the bell fails to ring, then the driver assumes that the line is clear. This is an objection that must be raised against Mr. Raven's system, which is being tried on the North-Eastern Railway. Mr. Boult in his system overcomes this objection, but we are afraid the cost of his system is prohibitive, and especially when the number of signals is remembered. There is no doubt that of the methods proposed for opening whistles, ringing bells, and putting on brakes, the bell system is the best, as by it a line-clear indication can be given, which is not the case with the other two classes. But we are afraid that the adoption of any such method is not an event of the near future. Locomotive superintendents will not readily agree to greater responsibility and strain being thrust upon their men by having to keep their eyes on a small indicator and to listen for the sound of an electric bell. Again, were such a system adopted, and fogmen were withdrawn, a driver would find himself in a very difficult position should the apparatus on the engine fail and be out of order."

The article concludes with an extract from a report made some time ago by Colonel Yorke, summarizing the difficulties in the way. Enginemen, relying on the apparatus, will pay less heed to the visual signals; if used at all, the fog signal must be used with every stop signal, and this introduces a difficulty at junctions and at slotted signals; also at all large and complicated yards. The object of *The Engineer* in publishing this article at this time is to induce the public to restrain its impatience, and to recognize that the railroads will welcome any solution of the problem of delays in times of fog, which will be "efficient, trustworthy, and capable of universal adoption."

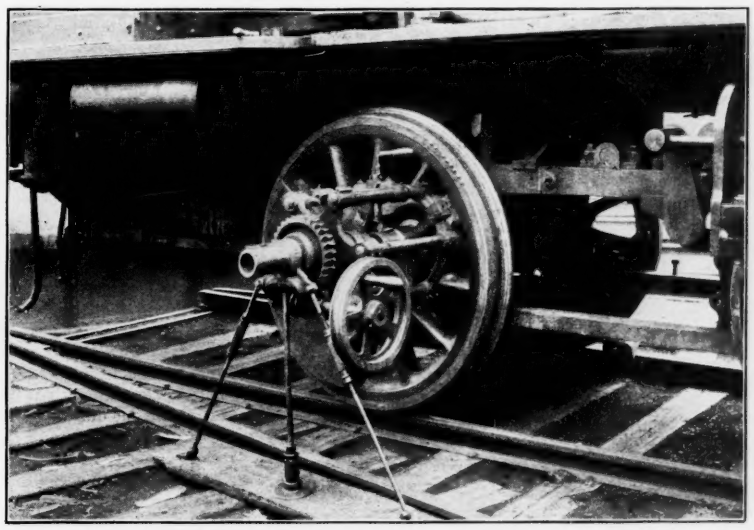
The Clover Crank Pin Machine.

We show in the accompanying engravings a new machine that has been designed to turn off crank pins without removal of the pin from the crank or driving wheel.

The device consists of a main revolving head with six arms extending forward so as to inclose the pin, and having a ring with adjustable steady-rest jaws at their outer ends. Two of these arms carry the tool head, and the feed is operated by a feed-screw and star. The main revolving head is carried on a hollow mandrel, which latter is attached to the end of the pin by a ¾-in. collar-bolt, tapped into the head of the pin. This collar-bolt may be reached by a socket wrench inserted within the hollow mandrel.



Clover Crank Pin Turning Machine.



Crank Pin Machine Turning Off Pin on Locomotive.

The machine is centered by means of four screws in the collar on the end of the mandrel next to the pin. These screws bear against the collar bolt in the end of the mandrel, the hole through which it passes being sufficiently large to permit all necessary adjustment.

Fitting over the mandrel and forming the journal for the revolving head is a long taper sleeve, provided with means of adjustment for taking up the wear between it and the hub of the head. This adjustment is accomplished, and the sleeve and head retained in place by the two collars, seen in the longitudinal sectional view.

These machines are made to turn any size of pin above 2 in. in diameter. A special machine is made for railroad work.

The method of attaching to pins having threaded ends for lock nuts is to screw a threaded cup on to the thread on the end of the pin. This cup is drilled and tapped at its bottom or back end for the insertion of the collar-bolt in the end of the hollow mandrel.

The tool may be operated either by hand or power. It is compactly built, is light and easy of application, one man being able to attach it without trouble. Besides being used for crank pins, the ends of shafting may also be turned down to fit couplings. It is made by the Clyde Machine Works, Chicago.

Wear of Steel Tires in Germany.

There has recently been published an elaborate summary of a report on the wear of steel tires on the German railroads. This report has been made annually since 1886, in accordance with a resolution adopted by the German Railroad Union. The statistics now printed cover ten years, from 1887 to 1896 inclusive, and include all of the wheels running under the cars of the German Railway Union. Of these wheels there were 2,014,025 in 1887. These have increased until in 1896 there were 2,785,723 wheels in service. Of these a small number were of cast-iron, in one piece, the majority being fitted with steel tires. Cast wheels, of cast-iron or steel, have decreased in number from 19.03 per cent. of the whole in 1887 to 15.61 per cent. in 1894. Even this low average was not maintained evenly throughout all of the countries of the Union, but was increased by the comparatively high percentage in use in Austro-Hungary, where it averaged about 25 during the 10 years, though subjected to an almost constant decrease.

In Germany proper, the cast wheels are usually made of steel and fell from 14.55 per cent. in 1887 to 118 per cent. in 1894. On the other roads of the Union the use of this type of wheel has never been common, and even the small percentage of 3.58 in 1887 fell to 1.8 in 1896. It thus appears that while the cast wheel has been universally used in freight service and largely in passenger service in the United States, and has been favorably received in Austro-Hungary, it has continually lost ground in comparison with the steel-tired wheels upon all of the roads of the Union; the reason for which will appear later.

In the report under consideration the breakages are divided into actual ruptures and cracks. The tables show a steady decrease in the total number of breakages from year to year, in spite of the corresponding increase in the number of wheels in use.

It has been found that the ratio of breakages is just twice as high on tenders as on locomotives and cars, and further that the ratio of cracks to actual ruptures is about the same in the three cases, that is, as 8 to 10.

The number of breakages of the cast wheels increased from 1891 to 1896, apparently on account of the greater average age of those in use, since there were comparatively few renewals. At the same time the total number of breakages where the wheels went to pieces is lower with the cast than with the steel-tired wheels. But it should be remarked that, in the case of cast wheels, a breakage of this character is a far more serious matter than in the case of steel-tired wheels, where a fracture extending entirely through the tire may do no harm because of the fact that the latter is held in position by its fastenings.

Again, it appears from the figures presented that the proportion of breakages for the same mileage was no more under freight than under passenger cars, the influence of the hand-brake on the weight carried upon each wheel being evidently balanced by the increased speed of the passenger cars. It also appears that the proportion of breakages is higher for postal cars than for others running at high speeds. This is probably to be explained by the fact that the weight stands somewhat higher above the rails than in passenger cars and vans or possibly by the higher speed of the trains in which they run.

On the other hand a comparison of the breakages of cast wheels in comparison with those having steel tires, shows that the number of the former is appreciably greater, and also that the breakages of the cast wheels instead of showing a steady decrease from year to year, as in the case of those having steel-tires, have increased especially of late.

As for the influence of the brake on the fracture of wheels, these statistics go to show that in the case of tender and truck wheels, the breakages are much more frequent where a brake is applied than where it is not. As far as the driving wheels are concerned, there are so many other and more important influences at work that the brake effect practically disappears.

Nearly all of the breakages are discovered by the inspectors and that comparatively few result in an accident on the road.

Particular attention has been paid to the influence of the season on the breakage of wheels. It seems that a crack, started in the winter, extends rapidly, so as to make a complete fracture under the influence of the rigidity of the track. It has also been suggested that the increase in the number of breakages is due to the difficulty of inspection on account of the long nights, so that the cracks seem to develop more rapidly than they really do, and are not detected until they attain certain proportions.

It seems to be an established fact that the cold weather has an injurious effect upon tires, since, during the winter, the breakages are not only more frequent but more serious. This position is strengthened by the fact that during moderate winters when considered from the standpoint of the countries of central Europe, the breakages are far fewer than during those exceptionally severe winters that occur every four or five years.

It will be shown, later, that the influence of low temperature on tires varies with the nature of the metal whether it be iron or steel.

In the case of cast wheels, the difference in the number of breakages during the several months of the year is less marked, the maximum not occurring in any one month. The frequency of breakages, instead of starting on the increase in December to reach the maximum in January; begins in January to increase to a maximum in February and March, to drop away again in an unbroken series to December, without fixing a true minimum during the hot seasons as in the case of steel-tired wheels. It *appears*, then, that the cast wheel yields to the influences of prolonged low temperatures more slowly than does the steel-tired wheel, but when once that influence has been felt it is dissipated far more slowly, even when the tracks have regained their elasticity. This suggests the prompt return of steel tires to a condition of molecular equilibrium that is favorable to a resistance to breakage.

While the value of the American heat test of car wheels is acknowledged, it is suggested that a cold test might be of equal value, and this would be still further enhanced by combining it with a heat test, whereby more complete data would be obtained as to the wheels capability of resisting the stresses arising in service. There is one point which will always be difficult to explain—the influence of prolonged service on a truck hardened by frost; and it appears to be equally difficult to decide as to what laboratory or inspection test will correspond to a rolling service upon an unyielding track.

As far as the ratio of actual breakages to mere cracks in cast wheels is concerned we find that, as in the case of steel-tired wheels, it is very low and varies with the different months of the years.

Coming now to the influence of thickness upon the breakage of steel-tired wheels the German statistics give the breakages categorically with reference to the service (whether on cars, locomotives or tenders), and the territory in which the breakage occurred. These statistics show that the proportion of breakages to the total number of failures decreased as the thickness of the tires decreased, while the proportion of cracked tires increased. This is merely another way of saying that the proportion of breakages is greater with new tires, while the number of cracked tires is greater with old ones. It would appear, from this, to be a fact that thick tires break on account of some inherent defect in the metal, while the principal cause of the failure of old tires is to be found in the weakening due to a reduction of the cross section.

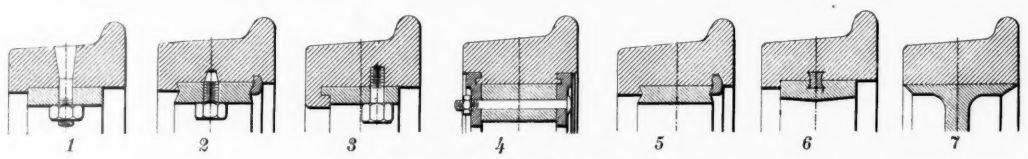
Since 1891 the German statistics have shown the thickness of tires in service and it has been possible to determine the failures of every thickness of tires advancing by 10 millimeters (.39 in.). Failures have been further divided among those having a greater and a less thickness than 30 millimeters (1.18 in.), and it has been found that the risk of breakage is about seven times as great with tires below this thickness as with those above it. With this as a basis it appears that if 1.18 in. had been taken as the minimum thickness of tires, when they should be replaced, the actual number of breakages would have been reduced by about 25 per cent., while the average life of all the tires in use would have been reduced only by about 5.1 per cent. By giving up a twentieth part of the life of the tires, the breakages would be reduced by one-quarter. There is no doubt that the figures here given and the fact that such results can be obtained, are responsible for the decision of the Union to limit the thickness of tires in service to 25 millimeters (.93 in.) as measured on the tread, and to recommend that a tire whose thickness is only 30 millimeters (1.18 in.) previous to the last turning shall not be put back into service. The result of this is that tires with a thickness of 20 millimeters (.79 in.) or less have practically disappeared from service, and those of 70 mm. or more have doubled in number. The statistics do not show the current use of tires with a greater thickness of from 75 to 88 millimeters (2.95 in. to 3.15 in.). But it is not probable that this practice has been put into effect on account of the opposition to the use of tires having a greater thickness than 70 millimeters (2.75 in.).

The first annual statistics gave the number of accidents caused either by steel-tired or cast-steel wheels, without reporting on the seriousness of the same or the importance of the disturbance to the traffic. Since 1891 these accidents have been classified under two main-heads: "Derailments" and "Delays to Trains." Out of 199 accidents annually reported in five years there were 43 derailments and 156 delays to trains only. The derailments for this same period caused by tire failures amounted to from 3.4 to 5.2 per cent. of the total number of derailments that occurred, giving an average of 4.2 per cent., or about one in 25.

The figures that are given for cars make it possible to gain an approximate idea of the relative value of wheels with steel tires and those cast in one piece (steel.) It is quite true that there have been more accidents with steel-tired wheels than with those that are cast, but it would be rash to jump to the conclusion that this necessarily indicates more favorable results as a whole. In the first place it must be taken into account that these cast-steel wheels are used only under freight equipment where the conditions cannot be compared in the matter of severity with that of passenger service, where speed is such an important element in the matter. When it comes to the proportion of derailments to delays caused by failures, the steel-tired wheel makes by far the most favorable showing. About 24.53 per cent. of steel-tired failures cause a derailment, while 61.6 per cent. of the failures of the solid wheels produce the same results. It will thus be seen that though the actual percentage of accidents to failures is less with the solid than with the steel-tired wheels, the danger resulting from the former is more serious.

The statistics do not so separate the breakages that it is possible to determine the influence of speed on the failure of wheels according to whether they are under passenger or freight cars or vans. There is, however, a special chapter devoted to locomotives and tenders, in which there is a résumé of breakages classified according to the character of the train that was being hauled. It appears that, in the 10 years during which the statistics have been kept, there has been an average of 1.48 failures for each million of locomotive miles on passenger trains, and 1.11 failures for the same locomotive mileage on freight trains. It is to be noted that there was a steady decrease in the number of breakages per million miles from year to year throughout the period during which the statistics have been kept.

A record has been kept of breakages since 1876, so that there are very complete statistics of the influence of age or the date of manufacture upon tire failures. It appears from this that the tires made at the earlier dates were more liable to break than those manufactured in recent years. There are two reasons for this; in the first place there was a larger proportion of thin tires among those first made, and it has already been shown what may be the effect of thickness on the breakage, then there has been a great deal of improvement made in metallurgical processes and methods of manufacture by which the late output has profited, and which has served to give greater strength. The substitution of steel for iron also served to effect a great reduction in tire failures. The iron tire, which was exclusively used at first, became more and more rare until it finally disappeared.



Types of Tire Fastenings in Germany.

Taking up the subject of the distance run by the tires of locomotives and tenders, it appears that the greatest number of breakages occur when a mileage of about 62,000 has been made. The mileage, however, at which breakage occurs averages about 85,500 for Germany and 103,000 for Austro-Hungary.

Fastenings.—Naturally in such an inquiry as this especial attention has been paid to the influence of the methods of attachment on tire failures. The different methods of fastening the tires to the centers have been classified into two groups according as the section is or is not weakened at certain points of attachment. Each of these two groups is sub-divided into two classes according as the tires can or cannot be held for the whole length of the periphery of the rim. There are 30 methods of tire fastenings in use in Germany, of which nine had not received 10,000 applications up to 1896. The other 21 are grouped under seven heads. These seven types are shown in the illustration.

These types are themselves very unequally represented in the total number of tires used; the most common method being the old form shown in No. 1, where the tire is held by a bolt or rivet and the various forms of retaining ring. These two types have been applied to from 85 to 90 per cent. of all of the tires in service, but it may be remarked that the old method of holding with bolts or rivets is gradually disappearing and giving place to the retaining ring; the increase in the application of the latter being in direct proportion to the decrease in the use of the former.

The method of attachment by the use of the retaining ring shown in No. 5 has received an extensive application, and is continually on the increase. This type includes the Standard Prussian, the Borck and the Gluck-Curant systems. These three are the ones in most common use and cover about four-fifths of all wheels using the retaining ring.

A table of the proportion of breakages to tires in use shows the incontestable superiority of those indicated in the illustration as Nos. 4 and 5, the old method of fastening being classed as amongst the most defective.

From the standpoint of efficiency the various methods of attachment may be classified as follows:

a—Double (No. 4) and single (No. 5) retaining ring.

b—Circular retaining ring with screw (No. 2) and tire welded on (No. 7).

c—Old method of fastening with screw and lips (No. 3).

d—Tires with embedded ring (No. 6) and old method of fastening with bolts (No. 1).

Among those methods holding the first rank, the double gripping retaining ring is far less extensively used than the single one. The reason for this is to be found in the fact that it is more expensive and does not lend itself as readily to the requirements of material already in use. Again, while showing a greater proportion of failures the actual breakages are less, but this can be readily due to the favorable conditions incident to its application, and especially to the type of center whose influence upon

tire failures is so important. Again, when the moderate price involved in the application of the single retaining ring is taken into consideration, it is undoubtedly one reason why it has come to occupy the first rank in the application of tire fastenings and explains its rapid development during the 10 years under consideration.

The use of the bolt attachment in connection with the retaining ring as shown in No. 2, does not improve the results obtained with the ring alone, as would naturally be inferred from the weakening of the section of the tire at the point of application of the bolt.

The tire welded to the center, as shown in Fig. 7, has given fairly good results, but it was used so little during the period under consideration that a final decision must be left to later developments. The method of fastening by means of an embedded ring, as shown in No. 6, gave comparatively poor results.

Finally these statistics show that the old method of fastening by means of simple bolts or rivets, as shown in No. 1, which is classed in the lowest rank, and which German practice shows a tendency to abandon more and more, has shown even less favorable results than tires provided with a lip to resist lateral displacement, as shown in No. 3.

The various metals used in the tires of German railroads have been divided into seven classes, to wit: Crucible steel; Bessemer steel; Martin steel; miscellaneous varieties of steel; puddled steel; hard iron and fibrous iron.

In the matter of the proportional use of tires of these several metals it may be remarked that while only 84.76 per cent. of the whole were of steel in 1887, this percentage had grown to 95.47 in 1894, while a corresponding falling off had occurred in the case of iron tires.

The statistics for later years show that the use of iron tires has almost entirely disappeared, and the type shown in No. 7 is the only one that has been listed as being put into service later than 1891.

In the matter of steel tires, those of crucible steel have not varied much in proportional numbers, while those of Bessemer steel have shown a marked diminution with a corresponding increase in the number of Martin steel.

Classification of Failures.—In classifying the tire failures, they have been divided into breakages across the rim and circumferentially, and it appears that, while the transverse crack is the more common one with steel the circumferential is the one most frequently encountered in iron. We find, furthermore, that when iron tires were in common use, cases of breakage of this sort were very common and of a character that rendered the failure dangerous on account of the liability to cause derailment, and also because it could not be remedied by any of those forms of fastening that serve as a protection in the case of a transverse breakage. It may be noted here that, as far as transverse breakages are concerned, the Martin steel has given the best results.

It has been found that 80 per cent. of the breakages of steel tires take place between December and March. The division of the breakages over the several months is practically the same for the different varieties of steel, and the curve of each coincides very closely with that of steel considered as a whole. Finally it has been established that the steel tire is in general superior to the iron one in durability and strength, that it avoids the dangers due to circumferential cracks so common in iron, and that it is not impossible to procure grades of steel, which in spite of the unequal occurrence of breakages throughout the different months of the year, are less liable to breakage, even during the winter, than the varieties of iron previously used. This is especially true of Martin steel.

The later German statistics show an attempt to investigate the character of the output of the different mills, but it is, as yet, quite impossible to draw any conclusions from these reports, because the average length of service of the several makes of tires is not known, and the output of each firm quite undetermined. Of the tires covered by the period under consideration, about 70 per cent. were of German manufacture, from 15 to 20 per cent. were Austro-Hungarian, and the rest from various countries, mostly from England and Belgium.

From the standpoint of the influence of the grade of metal on the failures of wheels cast in one piece, these statistics only take car wheels, passenger and freight, into consideration, as this class is very rarely used under locomotives and tenders.

There are two classes of wheels of this kind in use: One is cast in a chill with a hard tread and is mostly used on the Austro-Hungarian roads; the other is of cast-steel and is used for the most part on the German roads.

A comparison of the number of breakages in proportion to the number of wheels of each kind in use shows that the ratio of failures of all kinds is higher with the cast-iron than with the cast-steel wheels. As for the gravity of these failures it appears that the cast-iron wheels show the larger number of circumferential breakages in proportion to the total number that have occurred, and a lower proportion of other classes, but when the comparative danger involved in this class of failure is taken into consideration it would appear that the steel wheel is markedly superior to the one of cast-iron.

The conclusions deducted from a careful analysis of this report seem to show that the total number of failures of tires and wheels upon the entire rolling equipment of the roads of the German Railroad Union for the period under consideration, has shown a steady and continuous decrease. The number of accidents or interruptions to the service, such as delays or derailments, caused by failures of tires or wheels, has followed a path of decrease parallel to that of the failures themselves.

There is no need of surprise as to the relative standing of the two types of wheels when the different results of the action of each, as set forth by the statistics, are considered, and which are gathered in the following résumé:

CONCLUSIONS.

Steel-Tired Wheels.—The steady improvement in the service rendered by these wheels, as shown by the great reduction in the ratio of breakages to the number of wheels in service and their mileage, is due to the following causes:

1. The increase in the limit of minimum thickness for the renewal of worn tires which are naturally more brittle than new ones; an inexpensive measure, and a most efficient one for the reduction of the dangers of breakages since, by sacrificing one-twentieth of the life of the tire the risk of breakage is reduced one-quarter.

2. The improvement in manufacture due to the advancements made in metallurgical work which have contributed to the substitution of steel for iron. Iron tires comprised only 4 per cent. of the total number in use in 1896.

Bessemer Steel.—This metal, though showing a smaller number of annual breakages than iron, is, nevertheless, characterized by a tendency to fail in the winter.

3. The adoption of improved methods of fastening. The old methods of fastening by bolts, screws and rivets is being used less and less and are giving way to those that do not weaken the section of the tire.

Cast Wheels or Wheels in One Piece.—Cast wheels, taken as a whole, have fallen far short of giving results that could hold their own in comparison with those obtained with steel-tired wheels.

The number of failures annually in proportion to the wheels in service, has increased rather than diminished, and down to 1896 the law of increase does not seem to have reached a point of equalization.

The influence of severe winters has also been as disastrous to the cast as to the steel-tired wheels. The distribution of breakages over the several months of the year has been almost as unequal for this as for the steel-tired wheels.

The proportion of complete breakages relatively to the number of total failures of all kinds seems to have been less than for steel-tired wheels, but it is difficult to apply any efficient remedy to provide against this kind of failure, as may be done in the case of steel tires by the use of a suitable fastening, which may serve to counteract the disastrous results arising from a transverse breakage through the tread.

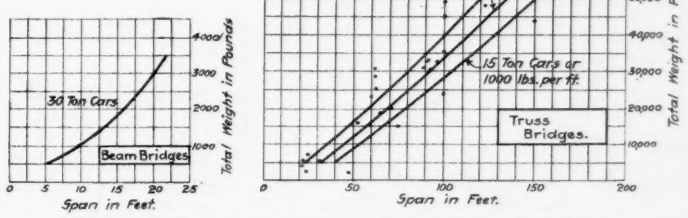
Finally that portion of the statistics devoted to the records of wheels as divided into years, shows that the manufacture of cast wheels is more uneven than that of the steel-tired ones, and that the progress shown in the latter has not been realized in the former when the whole output is taken into consideration. Of the two kinds of wheels of this sort used under the rolling stock of the roads of the Union, the cast steel wheel of the German manufacture does not seem to have given as satisfactory service as the hard cast-iron one made in Austro-Hungary.

Weight of Steel in Bridges for Electric Railroads.

BY H. G. TYRRELL.

The following table of curves gives the total weight of steel in single track bridges for electric railroads for spans up to 200 ft., according to the new specifications recently adopted by the Board of Railroad Commissioners for the State of Massachusetts. The weight of steel in bridges to carry two tracks of railroad will be about 90 per cent. greater than that given for one track. These bridges are designed for railroad traffic only, no floor being provided for pedestrians or carriages. The weight of ordinary street bridges with provision for car tracks had already been published by the writer in London *Engineering*, June 8, 1900.

The electric railroad bridges described in this article have steel stringers. Weights are given corresponding to live loads of from 1,000 to 2,000 lbs. per lineal foot of track. The points joining the curves are actual weights from which the curves were plotted. These weights are approximately expressed by the following formulæ where l is the length of span center to center of bearings, and W is the weight in pounds per lineal foot. Beam bridges $50 + 5\ l = W.$; truss bridges for 2,000 lbs. live load per ft., $250 + 1.5\ l = W.$; truss bridges for 1,000 lbs. live load per lineal ft., $200 + .8\ l = W.$


30 Ton Cars.
Beam Bridges
Total Weight in Pounds
Span in Feet.
30 Ton Cars or 2000 lbs. per ft.
1500 " " "
15 Ton Cars or 1000 lbs. per ft.
Truss Bridges.
Total Weight in Pounds.
Span in Feet.

Weight of Steel in Single Track Electric Railroad Bridges.

Extracts from the specifications are as follows: For bridge floors either a 20-ton 4-wheel car with 7 ft. wheel base, or a 30-ton 8-wheel car with 17 ft. total wheel base, and 4 ft. truck wheel base. The fiber stresses to be used in the floor are as follows (the material being medium steel), for I-beams 12,000 lbs. per sq. in., properly reduced according to the ratio of width of flange to total length, when this ratio exceeds 20. For plates and shapes 12,000 lbs. per sq. in., in tension, and 12,000 lbs. per sq. in., reduced by the usual formula according to the distance unsupported. Shop driven rivets in shearing 10,000 lbs. per sq. in. and in bearing 16,000 per sq. in.; field driven rivets to be reduced 25 per cent. below these figures. No rivets less than ¾ in. to be used.

For trusses, uniform loads shall be assumed, varying according to the length which is to be covered by live load to produce maximum stresses, from 1,500 lbs. per running ft. per track for a loaded length of 100 ft. down to 1,000 lbs. per running ft. of track for a loaded length of 300 ft., and proportionately for other lengths. The following may be the stresses per sq. in.: For tension, 15,000 lbs. per sq. in.; for compression, 12,000 lbs. reduced by the Rankine Formula; for rivets, however, the same stresses should be used as for the floor.

TECHNICAL

Manufacturing and Business.

Mr. George Gould's private car "Atlanta," now building at the car works at St. Charles, Mo., is being equipped with the Consolidated axle light system of electric lights and fans.

The New York Electric Headlight & Train Lighting Co., of Yonkers, N. Y., has been incorporated by H. D. Crippen and W. J. Huston, of New York City, and F. A. Curtiss, of Nutley, N. J.

"The Song of the Elevator," a pamphlet sent out by the A. Leschen & Sons Rope Co., St. Louis, Mo., tells in verse the tribulations of the elevator that is constantly being stopped for repairs because of being equipped with a hoisting cable that wears out rapidly, and the joyous song of its mate having the Leschen flattened strand cable which lasts for years.

The Stanley Rule & Level Company, of New Britain, Conn., are about to adopt electric driving throughout their works. They have recently purchased from the Westinghouse Electric & Mfg. Co. a 375-K.W., 500-volt, direct current, engine-type generator, to be operated in connection with a marine-type engine, running at 200 r.p.m. furnished by Messrs. Westinghouse, Church, Kerr & Company.

The Raymond Concrete Pile Co., Chicago, a description of whose system of concrete piling was given in our issue of Aug. 8, has been reorganized. The company was originally incorporated under the laws of Nebraska. The reorganization is under the laws of New Jersey, and the following are the officers of the new company: S. W. McMunn, President; A. A. Raymond, Vice-President and General Manager; Arthur B. Cody, Secretary; H. R. Moyer, Treasurer; Marcus Eaton, General Counsel.

The Chicago Pneumatic Tool Company, air compressor department, reports that the air compressor plant at Franklin, Pa., is running day and night. Among recent sales of importance are two large compound compressors for the New York Central's Jersey Shore shops; two large compressors for the Readville shops of the New York, New Haven & Hartford; a compound compressor of 2,000 cu. ft. capacity per minute, for the Lake Shore & Michigan Southern's Collinwood shops, being a duplicate of the first compressor installed; a 1,000-ft. compound compressor for the St. Louis, Iron Mountain & Southern, and one of the same capacity for the new shops of the Big Four. They have also secured the Government's order for the installation of a 1,000-ft. compound compressor at the Norfolk navy yard. Other sales include five large-size straight line compressors to the American Lime & Stone Company, Tyrone, Pa.; a 1,000-ft. compound compressor to the Mobile & Ohio for the shops at Mobile, Ala., and one of 500 cu. ft. capacity to the Louisville & Nashville.

Iron and Steel.

The Dominion Iron & Steel Co. has completed arrangements to take over the property of the Dominion Coal Co.

Application will soon be made on the New York Stock Exchange to list the securities of the American Steel Foundries Co., which has $40,000,000 capital.

The stockholders of the Clearfield Steel & Iron Co. have voted to increase the capital to $500,000. A plant is now building at Clearfield, Pa., with Alan Wood Smith as Superintendent.

H. G. Saylor has been appointed assistant to A. R. Hunt, General Manager of the Duquesne mills, Carnegie Steel Co. He succeeds John J. Utech, who has resigned to become assistant to Joseph E. Schwab, President of the American Steel Foundries Company, with headquarters in New York City.

The National Steel & Wire Company, which was in-

corporated under the laws of Maine with $5,000,000 capital, is reported to have acquired control of the National Wire Corporation of New Haven, Conn., the De Kalb Fence Company, of DeKalb, Ill., and the Union Fence Company, also of DeKalb, Ill. The New Haven rod mill is now in operation and the other departments are under construction.

An officer of the Empire Iron & Steel Co., Niles, Ohio, has given out the following as the prospectus of that concern: "Our product will be sheet iron and sheet steel, and angles for light structural work. Will start to operate Oct. 1. Have six hot mills, two cold mills and a three-high 24-in. bar mill. Will manufacture iron and steel up to 60 in. wide and from No. 16 to No. 30 gage. Will make a specialty of a 'guaranteed' double refined iron sheet, also range steel and bowsocket polished sheets. Our galvanizing plant will be in operation about Jan. 1. Our output of iron and steel angles will be about 100 tons per day. For the present the heaviest angles we will roll will be 4 x 4." The officers of the company are: Wade A. Taylor, President and Treasurer; Charles S. Thomas, Vice-President and Manager; J. F. O'Dea, Secretary.

Dun's Review in its Pittsburgh report last week said: The feature of the iron and steel market continues to be the matter of transportation. Complaints are made every day regarding the inability of the railroads to supply sufficient transportation facilities, and the pig iron market is seriously affected by the shortage of coke. The coke furnaces are producing a large supply, but find it difficult to move the product promptly, and it is estimated that there are close to 8,000 cars ready for shipment in the Connellsville region. A number of blast furnaces in the Mahoning and Shenango valleys have been compelled to bank owing to the shortage of fuel, and present conditions are very undesirable at a time like this, when the iron and steel market is in the height of prosperity. There have been a few small sales of Bessemer iron for delivery in the last quarter of the year, and sales reported have been made at $21.75 at the furnaces, or $22.50 delivered at Pittsburgh. There is a good inquiry for steel rails, and a large tonnage is now in the hands of the producers. Standard section rails are quoted nominally at $28 a ton, but for prompt delivery premiums are being offered. The structural market is exceedingly active, and the mills have business ahead for months. Orders for steel plates continue good, and the market is stronger than it was a week ago.

A Heavy Freight Train.

On the 7th of this month a freight train was hauled on the Pennsylvania and New York Division of the Lehigh Valley Railroad, from Sayre to Weldon, which must have been amongst the heaviest freight trains ever handled by one engine in regular service for an entire freight division. The train was made up of 104 loads and weighed 4,013 tons. It left Sayre eastbound at 2:58 p.m., and arrived at Weldon at 9:05 p.m. This regular freight division run is 82.4 miles. The run was made, therefore, at the rate of 13.7 miles an hour, the engine taking water three times.

Pressed Steel Car Company.

Two large buildings, 600 ft. long, are being added to the McKees Rocks plant of the Pressed Steel Car Company. These buildings will provide for a continuation on a larger scale of the business which had been conducted at the Fox plant, at McCandless avenue and Fifty-fourth street, the site of which was sold about a month ago. The machinery from the old Fox plant is being removed to McKees Rocks and the output of the works there will be twice that of the old works.

American Society for Testing Materials.

It has been decided to issue future publications of the Society in the form of annual volumes. The Proceedings of the fifth annual meeting, Atlantic City, N. J., June, 1902, are now in preparation for the press, and will soon be available for distribution. The volume will contain some 300 pages. There is every indication that the Society is entering upon an era of marked prosperity, and that its influence in a field peculiarly its own is rapidly expanding. The last annual meeting was not only fruitful of valuable results, but the attendance was several times greater than at any previous period in the history of the Society.

The membership at the time of the meeting was 175, representing an increase of seven for the year. Since then 40 applications for membership have been received, bringing the total to 215.

Sterlingworth Car Works.

The capacity of the new Sterlingworth car shops at Eddystone, Pa., is to be 20 steel cars a day; not five cars a day, as we stated in a note published last week.

The New Railroad Spring Company.

The Iron City Spring Company, which will be ready for operation soon, as noted last week, has the following Board of Directors: D. C. Noble, James Neale, T. Hart Given, Leroy C. Noble, Henry Aiken, Thornton N. Motley and H. K. Porter. D. C. Noble is President, W. H. Gardner, Assistant Secretary, and George W. Little, Assistant Treasurer.

Oil Fuel on a Steamer.

Lieutenant W. Winchell, U. S. N., has made a detailed report of the results obtained by the use of oil fuel on the steamer "Mariposa." The test trip was between San Francisco and Tahiti and return, a distance of 7,000 miles, and was made at a mean speed of 13.58 knots an hour. The average horse power developed during the trial was 2,481, and the fuel consumption was 1½ lbs. of oil per horse power per hour. The crude oil was atomized by an air compressor with a capacity of 1,000 cu. ft. per minute at 30 lbs. pressure. After reaching Tahiti the tubes were scraped and the refuse collected barely filled two ash buckets. The boiler was found to be in good condition. Some difficulty was experienced in keeping the steamers free from impurities, and it is suggested that hereafter duplicate strainers be used. The oil supply to the burners was also somewhat irregular owing to the variation in temperature of the oil from the heaters. With the use of oil the engine room force was reduced from 36 to 20 men.

Roebling's Improvements at Trenton.

The John A. Roebling's Sons Co. is making some improvements to its plant in Trenton, consisting of three buildings, a leaded-cable shop 324 x 105 ft., one-story high, and two insulated wire buildings at right angles to the cable shop. Of the latter, one will measure 360 x 66 ft., and the other 490 x 66 ft. Both will be four stories high. The foundations for these structures are now being built. Work on a power plant of 1,200 h.p. has also been begun.

The Schoen Steel Wheel.

Mr. Schoen has erected at the Bethlehem Steel Works one unit of his new press and rolls for making solid steel car wheels. His further investment in this matter will be dependent upon the results of the trials of this unit. As the reader knows, Mr. Schoen's purpose is to establish a big plant near Pittsburgh, if the process is successful. He is quite confident that he can make a solid steel wheel in competition with the chilled cast-iron wheel. While the first cost will be greater, the better wear and the greater immunity from breakage will make the steel wheel cheaper in the end. The wheel will be rolled from cast steel blanks which have had a preliminary shaping in a press. Whatever the outcome of the studies and experiments now going on, Mr. Schoen deserves the thanks of the whole railroad world for his enterprise and liberality in studying this important subject. If he succeeds he will get a great money reward, and if he fails he will have the satisfaction of having made an important contribution to the development of the art.

The Johnson Railway Crossing Gate.

The rights and good-will of this gate have been bought by the Pneumatic Signal Co. (owners of the Standard Signal Co.), of New York city, and this company will hereafter make the gates. It is intended to make Johnson gates to be worked by pneumatic power.

Hall Gas Signals on the Lehigh Valley.

Twenty-seven semaphore signals, worked by the Hall Signal Company's gas motors, are to be put up on the line of the Lehigh Valley between Depew and Buffalo. These signals will take the place of disk signals and are introduced for the purpose of making the automatic signaling uniform throughout the length of the western division of the road, Manchester to Buffalo, the signals east of Depew being already of the semaphore type. Each signal will have a home and a distant arm.

THE SCRAP HEAP.

Notes.

The railroads carrying bituminous coal to Memphis have announced a reduction of 25 cents a ton in the freight rates.

In a fight on a passenger train near Osceola, Ark., Sept. 7, two passengers were fatally shot by a negro who was refused admission to the white passengers' car.

The Illinois Central, which is establishing long distance telephone lines on the most important divisions of its road, has just finished stringing the wires between Chicago and Council Bluffs. It is a metallic circuit, all copper.

According to a press despatch from Hartford the Railroad Commissioners of Connecticut are now requiring the use of power-brakes on all double-track street cars in cases where a new road or new equipment comes before the Commission for approval.

It is announced in Atlanta that the Southern Railway is to put on a fast mail train, which will deliver mail in Atlanta at 11 p.m., in about 22 hours from New York: and it is said that arrangements will be made in connection with this train to shorten the time of mails from New York to Birmingham and to New Orleans: to the latter city the time will be 33 hours.

On Sept. 2 the Railroad Commission of Texas issued an order, to go into effect the next day, requiring the St. Louis & San Francisco, and a number of affiliated roads, to reduce all their freight rates 20 per cent., the reason for the order being an announcement by the road of a tariff making a reduction of that percentage in the rates on salt from St. Louis.

The agreement entered into by the western railroads to advance grain rates between the Missouri River and Chicago is to go into effect on Sept. 15, according to present reports. The advance will be on the same basis as was proposed for Aug. 15. There will be an advance from 7 to 12 cents per 100 lbs. on wheat, and from 7 to 11 cents on other grain. Grain rates to the Gulf ports are to be advanced on the same date.

According to a Pittsburgh paper the firemen of the Pittsburgh Division of the Pennsylvania Railroad are now being promoted to enginemen after four years' service, and many new firemen are being engaged. There are 500 firemen on the division. This remarkable activity serves to afford some indication of the enormous volume of freight and passengers now being moved over this railroad. Heretofore, a fireman has usually had to serve about seven or eight years before there would be an opening for him on the right-hand side of the engine.

The newspapers report that indictments were returned by the Federal Grand Jury at Minneapolis, last week, against the presidents and the traffic managers of the Wisconsin Central and the Ann Arbor railroads for violations of the Interstate Commerce act. The men are H. F. Whitcomb, B. Johnson, W. M. Burt and W. H. Bennett. It is understood that the documents charge the officials with unlawful manipulation of rates with respect to flour and feed transported to eastern destinations. Evidence is said to have been adduced to show that secret rates were given to certain millers and that domestic flour was carried at the export rate. The bills are also said to contain a clause charging false billing. There were summoned as witnesses before the Grand Jury thirty prominent railroad officials and millers of the Northwest, but only three witnesses were heard. These are said to have been a Lake Shore agent at North Amherst, Ohio; a flour and feed dealer at the same place, and Mr. Smith, the auditor of the Interstate Commerce Commission.

The summer passenger business, including excursion business, on the railroads centering in New York City, appears to have been fully up to the average during the past season, and on most roads there has been a satisfactory increase. This is the substance of a two-column article in the *New York Commercial*, which has made inquiries of the general passenger agents. The article is headed "Excursion Business Greater Than Ever"; but the reader seeks in vain for any satisfactory figures, except in the case of one road. As usual, the general passenger agents confine themselves to glittering generalities. Each man will give out the statistics after all of his competitors have died. All, with one accord, agree with the G. P. A., who says: "We like to toot our horn to sell the fish, but after the fish are sold, prefer to let the horn remain untooted." He will not begin to compile the results of the excursion business until about 60 days from now. "The figures, therefore, will not be available [to the reporter] before that time."

According to a Pittsburgh paper the Wabash Railroad has secured from prospective shippers in Washington and Greene Counties, Pa., a hundred or more exclusive contracts for freight. The story is that the agents of the railroad company, presenting contracts in which the company agrees to have a railroad between Pittsburgh, Washington and Waynesburg by Oct. 1, 1905, have induced mine owners, farmers, and merchants to sign these contracts, and, in so signing, to agree to ship all their freight over the Wabash for 10 years, or to pay to that company a forfeit of $5 a ton on all freight sent by competing lines; the only proviso being that the rates by the Wabash shall be as low as by any other line. It does not appear how much importance should be attached to this statement, for nothing is said of the magnitude of the business controlled by those who have signed the contracts, nor whether their establishment are so located as to be able to take advantage of existing railroads.

United States Steel Extensions.

A director of the United States Steel Corporation says: "We have in mind some plans which will mean a tremendous increase in the earnings of the company. The litigation in which we are now involved has tied up these plans. We have decided to erect a $10,000,000 tube plant at McKeesport, Pa., and a $9,000,000 tube plant at Lorain, O. At these two plants about 15,000 men will be employed, and the output of the National Tube Co. will be increased about 10,000 tons per day. Lorain is about 100 miles from Conneaut, the site which Mr. Carnegie had selected for his tube plant shortly before the formation of the Steel Corporation. The output of this plant will be steel tubing exclusively. This site is the most favorable that could be chosen. The unfinished product can be received by boat at the point where it will be converted into finished steel, and the coal will be received by rail from Pennsylvania and West Virginia. The Carnegie Steel Co. is to build a new structural steel mill at West Hempstead, Pa., which will be the largest in the world.

"The heavy increase in the earnings is due largely to the greatly decreased cost of producing the raw material, and when the plans which we now have in mind are completed, the cost of the finished material will be greatly lessened. The demand for foundry iron is now greater than ever before, and more ore was shipped last week from the Great Lakes than ever before in the history of the country. Orders for 1,400,000 tons of steel rails have already been received, and nine-tenths of the southern iron which will be produced during the next year has now been contracted for."—*Wall Street Journal.*

Reserving Seats in Day Coaches.

The system of reserving railroad seats is not unknown in this country. A letter to the station-master generally suffices. In France the custom has been reduced to a science, and if any person be so disposed he could easily acquire two seats or more without the slightest fear that the vacant spaces would be seized upon by belated travelers. The "pretick," or beforehand ticket, has been used for a year on the Paris-Royan and Bordeaux-Nantes lines, and will soon be applied to all the express trains on the Northern of France. The machinery is simple enough. The traveler applies at the station for a numbered ticket or "garde-place." The counterfoil of this ticket is taken by the guard or other official, and dropped into a little glass slit over the seat selected. The number of the ticket and the traveler's destination are marked

very plainly on the counterfoil. The traveler is thus in possession of his seat or seats, according to the payment made, and nobody else may take possession under pain of being turned out of the carriage. These tickets are distributed gratuitously if applied for at the time of departure, but seats may be booked ahead on taking one's ticket and on paying one franc. You may even go to the station, two or three days beforehand, and for 2½d. buy at any booking-office a "pretick." On this you write your name and address and the train by which you intend to leave. This you put into an envelope with one franc, and post to the station the night before. On arrival at the station—even at the last moment, and although the train may be crowded—there are the seats secured.—*Herapath's Journal.*

Fast Run on the Wabash.

On Friday, Aug. 29, a train of the Wabash Railroad was run from Detroit to Chicago in 5 hrs. 15 min. For 247 miles the average speed, deducting a number of delays, was 66 miles an hour. This run was made with a special train carrying Mr. George J. Gould. It had three cars. In the fourth district it was drawn by engine 611, Atlantic type, weight on drivers, 81,600; cylinders, 19 x 26; drivers, 78 in. In the third district, engine 118, eight wheels; weight on drivers, 60,800; cylinders, 18 x 24; drivers, 68 in. The best intermediate runs were:

	Miles.	Minutes.	Per hour.
Delray to Montpelier	93	80	69.7
Willis to Britton	18.2	15	72.8
Alvordton Junction to Montpelier	11.1	9	74
South Milford to New Paris	29.6	26	68.3
Wakarusa to Dillon	29.1	24	72.7

Stevens Institute.

The announcement is made that Mr. Alexander C. Humphreys has accepted the presidency of the Stevens Institute of Technology. It will be remembered that the trustees elected him to this office shortly after the death of Mr. Morton, but Mr. Humphreys could not decide until after he had carefully considered his own business arrangements. The choice is probably fortunate, and Mr. Humphreys doubtless accepts the position rather from love of the Institute than from any other motive. He is a distinguished graduate and has long taken a deep and active interest in the Institute. He must sacrifice a good deal in a money way for the sake of the work which he will be able to do in the presidency.

Lake Commerce Through the Canals at Sault Ste. Marie, August.

Eastbound: Copper, net tons, 12,198; grain, bushels, 148,372; flour, barrels, 1,107,398; iron ore, net tons, 3,691,413; lumber, M. ft. B. M., 177,014; wheat, bushels, 3,530,706. Westbound: Coal, soft, net tons, 681,241; manufactured iron, net tons, 28,262; salt, barrels, 44,832; general merchandise, net tons, 75,517. Total freight, net tons, 5,070,491; vessel passages, number, 3,197; registered tonnage, net tons, 4,378,630.

German Export of Locomotives.

German manufacturers have recently received orders for 100 locomotives, representing a value of $1,500,000, which will go to Siam, Italy, India and Denmark. While the German export of machinery as a whole has decidedly decreased during the past year, the export of locomotives and traction engines has advanced considerably, as shown by the following figures: 1899, $2,689,400; 1900, $3,736,600; 1901, $5,259,000.

In the figures for 1899 and 1900, traction and passenger cars and motor wagons to the value of $700,000 to $800,000 are included. As to weight, there were 67,609 tons of locomotives and traction engines exported in 1900 and 100,762 tons in 1901.

A Twelve-Wheel Evangelist.

"Evangelist" is the name of a handsome car 72 ft. long, described in a Philadelphia paper, which has been built for the use of Rev. Dr. Henry M. Wharton, of Baltimore. The car was presented to the clergyman by Mrs. Mary S. Geiger, of Johnstown, Pa., whose son, a musician, accompanies Dr. Wharton. A tent is carried, folded in a suitable receptacle beneath the floor of the car, which is used for meetings where the evangelists stop, the car itself being designed for use as a dwelling and an office and not for meetings. The apartments are a drawing room, two sleeping rooms, with baths, a kitchen and a dining room. It is said that the first tour, which is to be begun next week, is to be taken for the purpose of raising funds for certain orphanages; from which it would appear that the term "evangelize" has been somewhat broadened.

The Chinese Eastern Railroad.

The Chinese Eastern Railroad (Manchurian) is about to open direct passenger communication from Moscow to Port Arthur. The trains on the South Ussuri Railroad will meet steamers which run between the Russian ports on the Pacific and the ports of China and Japan. Moreover, the railroad proposes to organize regular steamship communication on the Ussuri and Sungari rivers, to the station of Iman, on the Ussuri line. This small town is growing rapidly. There are dense forests in the vicinity which furnish sleepers and logs for the Chinese and Siberian railroads. At the opening of regular passenger communication on the Chinese Eastern Railroad, there will be 10 cars of the International Sleeping-Car Company at the junction stations, and this number will be increased on Jan. 1, 1903, to 40 cars on the Manchurian Railroad.—*Consular Reports.*

The Manchurian Railroad.

Under date of July 30, 1902, Commercial Agent R. T. Greener, of Vladivostock, transmits the following data in regard to the Manchurian Railroad:

The loss and delay to the road occasioned by the Boxer outbreak can hardly be computed, and when work was resumed it was under the protection of Cossack troops. In 1901, construction trains were running over all the sections and the whole system was open to temporary traffic in November, 1901. In December of the same year, a regular mail service was organized, the trip from Harbin to Port Arthur being made by an official in 36 hours. The road was formally opened to the public Jan. 1, 1902. The committee of experts have estimated the total cost of the road up to Jan. 14, 1902, to be 160,000,000 rubles ($82,400,000). The receipts from July 1 to Nov. 9, 1901, as reported, were 1,447,441 rubles ($745,432). Passenger and baggage traffic figured at 188,286 rubles ($96,967); freight traffic, 955,379 rubles ($492,020); sundries and Government service, 383,776 rubles ($197,645). A daily train is scheduled to leave Manchuria station for Vladivostock via Harbin (time, 112 hours) and for Port Arthur (time, 125 hours).

LOCOMOTIVE BUILDING.

The Central of Brazil is having four locomotives built at the Baldwin Works.

The Ozark & Cherokee Central has ordered 10 ten-wheel locomotives from the Baldwin Works.

The Fort Worth & Denver City has ordered four eight-wheel engines rebuilt at the Hicks Locomotive & Car Works.

The Long Island has ordered four 10-wheel; four 8-wheel, American type; two consolidation and two switching engines.

The Fremont, Elkhorn & Missouri Valley is having a locomotive built by the American Locomotive Co. at Schenectady.

The Duluth, Missabe & Northern is having three locomotives built at the Dickson Works of the American Locomotive Co.

The Houston, Beaumont & New Orleans is having 10 locomotives built at the Cooke Works of the American Locomotive Co.

The Seaboard Air Line is reported to have ordered 22 consolidation engines and nine other engines from the Baldwin Works.

The Mexican Central expects to order one or more passenger locomotives in addition to the one freight engine now being built at the Baldwin Locomotive Works.

The Chicago Great Western order for locomotives with the Brooks Works of the American Locomotive Co., calls for 20 simple passenger engines of the "Lake Shore" type, and 20 freight engines for January and February, 1903, delivery. The passenger engines will weigh 160,000 lbs.; cylinders, 20 x 26 in.; diameter of drivers, 68 in.; wagon top boilers, with wide fire-boxes and a working steam pressure of 200 lbs.; number of tubes, 260, with outside diameter of 2 in., fire-box to be built of Carnegie steel 78 x 74 in., and a grate area of 40 sq. ft.; tank capacity for water, 6,000 gal. The freight engines will be of the Prairie type, with boilers similar to the tandem engines purchased from the Brooks Works this year, but further details have not as yet been decided.

The Baltimore & Ohio order for 100 locomotives, for which contract was let Aug. 23, for August, September, October and November, 1903, deliveries, calls for 50, type I-7 consolidation locomotives from the American Locomotive Co.; 25 I-7 consolidation locomotives from the Rogers Works; 10 Atlantic type engines from the American Locomotive Co., and 15 six-wheel switchers, class D-7, from the Baldwin Works. The 50 consolidations to be built by the American Locomotive Co., and the 25 to be built by the Rogers Works will weigh on drivers 173,000 lbs.; total weight, 193,000 lbs.; cylinders (simple), 22 x 28 in.; diameter of drivers, 56 in.; Belpaire boilers, with wide fire-box and working steam pressure of 205 lbs.; tubes of charcoal iron, 13 ft. 9 in. long and 2 in. wide; steel fire-box 107 in. long and 66 in. wide; tank capacity for water, 7,000 gal.; coal capacity, 11 tons. The 10 simple Atlantic type engines to be built by the American Locomotive Co. will weigh 110,000 lbs. on drivers; total weight, 177,700 lbs.; cylinders, 22 x 26 in.; drivers, 80 in.; Belpaire boilers with wide fire-box, sloping back head, and working steam pressure of 205 lbs.; number of tubes, 315, of charcoal iron, 15 ft. 1 in. long and 2 in. outside diameter; fire-box of steel, 111 in. long and 72 in. wide; tank capacity for water, 7,000 gal.; coal capacity, 11 tons. The 15 switchers ordered from the Baldwin Works will weigh 126,000 lbs., all on the drivers; cylinders, 19 x 24 in.; diameter of drivers, 50 in.; straight top boilers with radial stay on top of frame, and working steam pressure of 180 lbs.; number of tubes, 198, of charcoal iron, with outside diameter of 2¼ in., and 13 ft. 10 in. long; steel fire-box 78 in. long and 41 in. wide; tank capacity for water, 4,000 gal.; coal capacity, 6,000 lbs. Special equipment for all three classes of locomotives includes Westinghouse air-brakes, steel axles, National Hollow brake-beams, U. S. metallic piston rod and valve rod packings, and Coale open encased safety valves. The Atlantic type engines will have McKee-Fuller brake and tender wheels; the others will have cast-iron truck and tender wheels, and all will have cast-iron wheel centers.

The Illinois Central order for 50 locomotives, recently reported in our columns, calls for 32 simple consolidation, five 6-wheel switch and one simple Atlantic type engine ordered from the Rogers Locomotive Works, and 12 simple consolidation engines ordered from the American Locomotive Co. for delivery January to July, inclusive, 1903. The consolidation engines will weigh 188,000 lbs., with 163,000 lbs. on the drivers, and have 20 x 28 in. cylinders, 56½ in. drivers, and extended wagon-top-boilers, with a working steam pressure of 200 lbs., 336 National Tube Works Illinois Central special tubes, 2 in. in diameter, 14 ft. 7⅝ in. long, with carbon or Otis steel fire-box 108 in. long and 72 in. wide, tank capacity 7,000 gallons of water and 15 tons of coal. The switch engines will weigh 118,900 lbs., and have 19 x 26 in. cylinders, 51 in. drivers and straight wagon top boilers, with a working steam pressure of 165 lbs., 220 National Tube Works Illinois Central special tubes, 2 in. in diameter, 11 ft. 7 11/16 in. long, with carbon or Otis steel fire-box 112 in. long and 33¾ in. wide, tank capacity 3,000 gallons of water and 7 tons of coal. The Atlantic type engine will weigh 178,600 lbs., with 95,710 lbs. on the drivers, and 20 x 28 in. cylinders, 79 in. drivers and extended wagon top boilers, with a working steam pressure of 200 lbs., 335 National Tube Works Illinois Central special tubes, 2 in. in diameter, 16 ft. 10 in. long, with carbon or Otis steel fire-box 102 in. long and 72 in. wide, tank capacity 7,000 gallons of water and 15 tons of coal. The special equipment for the consolidation engines includes: Westinghouse air-brakes, Taylor iron axles, Higginbottom bell ringers, M. C. B. brake-shoes, American Steel Casting Company's couplers, Illinois Central standard headlights, Simplex and Ohio injectors, United States or Jerome piston and valve rod packings, Ashton safety valves, Leach sanding devices, Nathan sight-feed lubricators, American Ry. Spring Company's springs, Ashton steam gages, Midvale truck wheel tires, Latrobe tender wheel tires and cast-steel wheel centers. The special equipment for the switching engines includes: Westinghouse air-brakes, United States iron axles, M. C. B. brake-shoes, American Steel Casting Company's couplers, Illinois Central standard headlights, Simplex and Ohio injectors, United States piston and valve rod packings, Ashton safety valves, Leach sanding devices, Nathan sight-feed lubricators, American Ry. Spring Co.'s springs, Ashton steam gages, and cast-iron wheel centers. The special equipment for the Atlantic type engine includes: Westinghouse air-brakes, Taylor iron axles, Higginbottom bell ringers, M. C. B. brake-shoes, American Steel Casting Company's couplers, Illinois Central standard headlights, Simplex and Ohio injectors, United States piston and valve rod packings, Ashton steam gages, Gould steam heat equipment, Midvale truck and tender wheel tires and cast-steel wheel centers.

CAR BUILDING.

The Rutland is having 40 freights built at the Laconia Car Works.

The Canfield Oil Co. is having 20 freights built at the Erie Car Works.

The Oregon Short Line is considering the purchase of some new coaches.

The Gate City Oil Co. is having 50 freights built at the Erie Car Works.

The National Refrigerating Co. is having 10 freights built at the Erie Car Works.

The Chicago & North Western is having 50 coaches built at the Pullman Works.

The Lehigh & Hudson River has ordered two milk cars from the Allison Mfg. Co.

The Dayton, Lebanon & Cincinnati is having 20 freights built by the Pressed Steel Car Co.

The Pennsylvania order for 650 freights, reported in our issue of Sept. 5, should be credited to the Pressed Steel Car Co.

The Lehigh Valley order for 10 milk cars, reported in our issue of Aug. 22, should be credited to the Allison Mfg. Co., of Philadelphia.

The Mobile & Ohio is building 100 freight cars at its own shops, and will be in the market for new passenger equipment in the near future.

The Allison Mfg. Co. has recently received orders for 190 ore and dump cars, and also for a few tank, refrigerator, and contractors' dump cars.

The Canadian Northern is having 200 freights built by the Illinois Car & Equipment Co., in addition to the order reported in our issue of Aug. 22.

The Mexican Central is having 10 freights built by the Illinois Car & Equipment Co., and contemplates ordering 25 gondolas and 50 box cars in the near future.

The Pearl & Leaf River order with the American Car & Foundry Co., recently reported, calls for three coaches only. These are for October or November, 1902, delivery, and will be 52 ft. 5 in. long.

The Ozark & Cherokee Central, reported Aug. 29 as being in the market for equipment, has ordered 400 box cars of 60,000 lbs. capacity from the American Car & Foundry Co. See also under Locomotive Building.

F. M. Hicks has received orders from the following for flat cars, to be rebuilt at the Hicks Locomotive & Car Works: Callahan Bros. & Katz, contractors; Charles Lennig & Co., Philadelphia; the West Virginia Northern and the Clearfield Southern Railroads.

The Southern Pacific has ordered 625 oil tank cars of 12,500 gallons capacity from the Standard Steel Car Co. These cars will be 40 ft. long, 9 ft. 2¾ in. wide, and the tank will be 94 in. in diameter, to be built of steel, with steel underframes. The special equipment includes: Steel axles; cast-steel bolsters; Southern Pacific Co.'s standard metal brake-beams and brake-shoes; M. C. B. vertical plane couplers, with 5 x 7 in. shanks; and Southern Pacific Co.'s standard cast wheels.

The St. Louis & San Francisco order for 1,300 box cars of 60,000 lbs. capacity placed with the American Car & Foundry Co., and reported in our issue of Aug. 29, was let Aug. 19, and is for November and December, 1902, delivery. The cars will be 36 ft. long, 6 ft. wide and 10 ft. 9½ in. high, to be built of wood, with wooden underframes. The special equipment includes: American Steel Foundry Company's bolsters, Sterlingworth brake-beams, spiral brasses, Trojan couplers, Frisco standard doors, Miner draft rigging, Waycott & Andrews dust guards, M. C. B. standard journal boxes, Chicago roofs, Scott springs, Diamond trucks and American Car & Foundry Company's wheels.

The Mexican Central has ordered 10 tank cars of 9,800 gallons capacity from the Western Steel Car & Foundry Co., for October, 1902, delivery. The cars will be 36 ft. long over end sills, 5 ft. 8 in. wide over side sills, and 11 ft. 9 in. high to top of filling hole. The tanks of these cars will be 33 ft. long over ends and 84 in. in diameter. The special equipment includes: Wrought iron axles and bolsters, National-Hollow brake-beams, cast-iron brake-shoes, Westinghouse air-brakes, M. C. B. standard brasses, Westinghouse friction draft rigging, Soule dust guards, cast-iron journal boxes, malleable iron journal box lids, Sherwin-Williams paint, Scott springs and Mexican Central standard 80,000 lb. trucks.

The Norfolk & Southern order for coal cars, reported in our issue of Aug. 22, calls for 750 cars of 100,000 lbs. capacity; weight of car, 38,000 lbs.; length, 30 ft. 9 in. inside; width, 8 ft. 9¼ in. inside; height, 10 ft. ½ in. from track; to be built of metal and wood with metal underframes. The special equipment includes steel axles, truss bolsters, N. & W. metal brake-beams, Christie brake-shoes, Westinghouse brakes, Phosphor bronze brasses, M. C. B. couplers, McCord journal boxes and Helical springs. Three hundred and seventy-five of the cars will be equipped with Westinghouse draft rigging and the remainder with Sessions draft rigging. Similarly half of the order will be equipped with standard N. & W. trucks and the remainder with Barber trucks.

BRIDGE BUILDING.

ANDERSON, CAL.—It is reported that a steel bridge will soon be built over the Sacramento River, replacing the wooden bridge now in use.

ANDERSON, IND.—The County Council has made an appropriation of $18,000 for the proposed bridge over

White River at Delaware street connecting Anderson with North Anderson.

ANGOLA, IND.—The Goshen & Indiana Traction Co., according to report, will need a number of bridges. The office is Anderson, Ind.

BATH, ME.—The Maine Central contemplates building a steel bridge over the Kennebec at Bath, but we are told that the surveys are not yet made.

BERRYVILLE, VA.—The Supervisors of Clarke County are again considering building a bridge over Shenandoah River at Castleman's Ferry. The bill for this bridge recently passed Congress.

CHICAGO, ILL.—New bids will be wanted on Nov. 5 for the substructure and superstructure of two Scherzer rolling lift bridges over the Chicago River at Eighteenth street and at Loomis street. The original date set for opening these bids was Sept. 3. A. R. Porter, Clerk, Sanitary District.

The American Bridge Co. and Roemheld & Gallery were the two bidders on the superstructure of the Division street bridge, Roemheld & Gallery being the lowest.

EVERETT, WASH.—The City Council is considering the report of the City Engineer in regard to the Everett avenue bridge. The Engineer estimates the cost of a steel structure at $50,000, but it is probable that a combination bridge will be built.

GRAND RAPIDS, MICH.—It is said that the Pere Marquette will not elevate its bridge over the Grand River, but will put a draw in the present bridge instead.

HARRISBURG, PA.—The city has signed the contract to permit the Pennsylvania R. R. to build a subway under the tracks at Herr street. It is said that the contract for this work will be let within two weeks.

IRON MOUNTAIN, MICH.—We are told that nothing is to be done for a while towards building the proposed bridge over the Menomonee River, as the county and the city members (of Amberg, Wis.) of the County Board cannot reach an agreement. The matter will have to be adjusted by the next Legislature.

LOS ANGELES, CAL.—An election will be held on Oct. 29 to vote on a new issue of bonds, $100,000 of which is intended for new bridges.

MANCHESTER, VA.—The Board of Supervisors of Chesterfield have ordered a new bridge built over Timsbury Creek.

MORGANTOWN, W. VA.—The county has appropriated $20,000 for a bridge over Decker's Creek from Walnut street. The work is being done under the jurisdiction of the city.

NEW YORK, N. Y.—The specifications for the bridge over the Bronx River at Tremont avenue, we are told, are now being printed and bids will soon be advertised for.

The proposed structure over the railroad tracks at Woodlawn Station, when ready for construction, will be under the charge of the New York & Harlem R. R.

OMAHA, NEB.—The contract for 2,100 tons of steel for the new bridge of the Illinois Central Railroad over the Missouri River has been let. The bridge will have a draw span 520 ft. long and 11 spans of 50 ft. each, the whole to be built for a double track, and the bridge complete will be 1,100 ft. in length.

OTTAWA, ONT.—The Department of Railways & Canals is about to ask bids for the substructure of the bridge to be built over the Welland Canal at Stonebridge. Bids have already been asked on the superstructure.

PEKIN, ILL.—The bridge proposed over the river at Pekin, it is said, will cost about $24,000. The matter is with the Mayor.

PEN ARGYL, PA.—The Lehigh & New England R. R. is considering plans for its proposed bridge over the Delaware River at Pen Argyl, but nothing has as yet been decided on.

PERTH AMBOY, N. J.—The Board of Freeholders received the following bids for the new Amboy bridge: American Bridge Company, New York, $148,600; Berlin Construction Company, East Berlin, Conn., $148,900; Sanford & Harris Co., Newark, plan A, $127,900; plan B, $138,000; plan C, $146,950; F. R. Long Company, Hackensack, plan A, $135,000; plan B, $142,000; plan C, $146,000; plan D, $149,000; plan E, $124,000.

PHILADELPHIA, PA.—Bids are wanted Sept. 20 by Wm. C. Haddock, Director, Dept. of Public Works, for the following bridge work: 1. Bridge on the line of Frankford avenue, over Poquessing Creek, between Philadelphia and Bucks Counties. 2. Work on west approach of bridge, on the line of Frankford avenue, over Poquessing Creek, in Philadelphia County. 3. Abutment and piers for west approach to proposed Passyunk Avenue Bridge over Schuylkill River.

PICTON, N. J.—The Plainfield & Elizabeth Trolley Co. will build a bridge over the tracks of the Lehigh Valley at this place.

PONTIAC, MICH.—The city contemplates building a concrete bridge 61 ft. wide and 30-ft. span. Wm. J. Fisher, City Engineer.

READING, PA.—The city officers and the United Traction Co. are considering building a bridge at Front street.

RICHMOND, VA.—It is again reported that the Citizens Rapid Transit Co. is preparing to build the viaduct at Marshall street, the cost of which, according to report, will be $125,000.

Bids are wanted Oct. 1 for a steel bridge over Turkey Island Creek. Address K. H. Cornwall.

ROME, N. Y.—Bids are wanted Sept. 15 by the State Superintendent of Public Works, Albany, for building the bridge over the Erie Canal at South James street, Rome; also for a bridge over the Allegheny River on the Allegheny Indian Reservation in the town of South Valley.

ROCKDALE, IOWA.—It is said the Illinois Central proposes to build a viaduct in this place.

SAN DIEGO, CAL.—City Engineer Geo. A. d'Hemmecourt has recently made plans for a bridge over San Diego River on Poway Road. His estimates vary from $7,942 for a pile bridge, to $31,823 for a steel bridge of 140 ft. span.

SIOUX CITY, IOWA.—The Council has made an agreement with the Traction Company in regard to building two bridges.

SOUTH VALLEY, N. Y.—See Rome, N. Y.

STEELTON, PA.—It is expected that the Steelton & New Cumberland Bridge Co. will take definite steps to build its bridge over the Susquehanna River between these two places before 1903.

TARENTUM, PA.—Bids are wanted Sept. 15 for a highway bridge over the West Penn R. R., the estimated cost of which will be $50,000. Knoff & Milholland are the engineers.

UTICA, N. Y.—The matter of building new bridges over the Mohawk, which is being straightened at this place, is now receiving attention.

WASHINGTON, D. C.—The War Department has approved a project prepared by Lieut. Col. Charles J. Allen, Corps of Engineers, in charge of Potomac River improvement, for the expenditure of $65,000 appropriated by Congress in July last for the reconstruction of pier 5 of the Aqueduct bridge across the Potomac River. Between the main abutments there are eight piers. The Army engineers have recommended the entire reconstruction of the bridge in preference to continued temporary repairs.

WINNIPEG, MAN.—The Canadian Pacific Ry. is considering the advisability of placing new steel bridges over the Souris River at Monteith and Treesbank, and over the Assiniboine River at Headingley, but nothing definite has been decided.

Other Structures.

BROOKLYN, N. Y.—The National Foundry Co. has recently bought a site on which it will build a modern foundry building for its exclusive use at a cost of $50,000.

CEDAR FALLS, IOWA.—The Rapid Transit Co. has decided to build its car shops at the Waterloo terminus. The work will be done this year at a cost of about $10,000.

CHICAGO, ILL.—Improvements costing between $1,000,000 and $2,000,000 are now being undertaken at the South Works of the Illinois Steel Co. in South Chicago. A large part of the work has already been done and plans for more are being discussed and other contracts are being let.

DURAND, MICH.—Fire on Sept. 6 destroyed the freight shed of the Grand Trunk and the Ann Arbor railroads, and also 30 freight cars.

FORT WORTH, TEXAS.—The International & Great Northern has just received bids for a roundhouse in Fort Worth which is to cost about $14,000. The contract will be let in about a week.

GUELPH, ONT.—The City Council is considering an agreement with the Page, Hersey Iron & Tube Co., of Montreal, to build a pipe mill in Guelph at a cost of about $125,000.

HOBOKEN, N. J.—It is said that W. D. Forbes & Co., manufacturers of machinery, contemplate a large addition to their plant.

HOXIE, ARK.—The St. Louis, Iron Mountain & Southern proposes to make some improvements at this place to consist of a roundhouse, machine shop and repair shop, for which the contract has already been let to Carey Bros.

KANSAS CITY, KAN.—D. M. Estey, of Owasso, Mich., tells us that the Safety Angle Bar & Railroad Supply Co. will probably be ready to get bids in 90 days for its proposed shops in Kansas City, Kan. They are to be of iron and steel and cost probably $100,000.

LATROBE, PA.—Plans are being made for a new passenger station for the Pennsylvania at this place which is to cost $20,000.

LOS ANGELES, CAL.—Plans have been made for the new arcade station for the Southern Pacific.

LOUISVILLE, KY.—R. Montfort, Chief Engineer of the Louisville & Nashville, will, in about two months, be ready to let contracts for the buildings and tools needed for the new shops in South Louisville.

MCKEES ROCKS, PA.—Plans and specifications have been prepared and bids are now being received for the extensive improvements at the McKees Rocks yards of the Pittsburgh & Lake Erie. Contract has already been made for the structural steel for the various buildings. The machine and erecting shop will be 560 x 170 ft. The following are a few figures giving general dimensions of other buildings: Boiler and tank shop, 275 x 100 ft.; storehouse, 100 x 75 ft.; freight car shop, 650 x 150 ft.; blacksmith shop, 200 x 74 ft.; coach shop and planing mill, 300 x 120 ft.; paint shop, 203 ft. 2 in. x 85 ft.; power house, 100 x 77 ft. In the latter all power for the plant will be generated, including steam, electric, pneumatic and hydraulic.

MEMPHIS, TENN.—It is said the Illinois Central proposes to spend nearly $400,000 on new shops in South Memphis instead of about $100,000, as at first proposed. The original plans have been changed to this extent. The bids for the new buildings were opened in Chicago Aug. 29, and contracts are now being let.

PITTSBURGH, PA.—Many warehouses are to be built by the railroads in connection with improved terminal facilities. The Baltimore & Ohio is taking options on a block of property bounded by Ross and Grant streets and Third and Fourth avenues, and it is said the plans have taken definite shape. The Wabash is to locate a series of warehouses on the southside, near Smithfield street, and smaller buildings at Ferry street; the Pittsburgh & Lake Erie has plans for the enlargement of its present warehouses alongside the southside terminal or the construction of entirely new ones; the Panhandle is to build large delivery stations above Sycamore street, southside, just north of the Birmingham Station, and the Pennsylvania Railroad, with its connections, is attempting to enlarge its facilities at the Point, and if possible girdle the Pittsburgh wharves with elevated tracks. The plans of the River Railroad & Terminal Company will involve the expenditure of $2,000,000.

ST. LOUIS, MO.—The Railway Steel Spring Co., general office New York City, intends to build a new spring plant in St. Louis, but the details are not yet fully decided upon.

WATERTOWN, N. Y.—The New York Air-Brake Co. has recently bought 275 acres of land for an addition to its plant which, it is said, will double the capacity. The contract for this work has already been let.

WICHITA, KAN.—The St. Louis & San Francisco is preparing to build a new passenger station 90 x 52½ ft., in this city. The plans were made by E. M. Roquette, of St. Louis. Bids will be wanted in a week or so.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad associations and engineering societies see advertising page xvi.)

Railway Signaling Club.

The next meeting of this club will be the annual meeting in November, which is to be held at Pittsburgh.

Car Foremen's Association of Chicago.

The regular meeting of the Car Foremen's Association of Chicago was held in room 209, Masonic Temple, Chicago, Wednesday, Sept. 10, at 8 o'clock. The entire evening was devoted to the discussion of the new M. C. B. Rules.

St. Louis Railway Club.

The opening fall meeting of the St. Louis Railway Club will be held Friday, Sept. 12, 1902, in the Administration Building, World's Fair Grounds. Addresses will be made by Hon. D. R. Francis and Mr. W. B. Stevens, and a paper on the India Bombay Station will be presented by Mr. T. S. Blish.

Western Railway Club.

The opening fall meeting will be held at the Auditorium Hotel, Chicago, Tuesday, Sept. 16. The following papers will be presented: "Locomotive and Car Scrap Bins," by T. A. Lawes, Superintendent Motive Power, C. & E. I. R. R.; "A Case of Leaky Flues," by S. W. Miller, Master Mechanic, P. C. C. & St. L. R. R., Indianapolis, Ind.

American Institute of Electrical Engineers.

The next meeting of the American Institute of Electrical Engineers will be held at 12 West 31st street, New York, on Friday, Sept. 26. A paper will be presented by B. G. Lamme, of Pittsburgh, on "The Washington, Baltimore & Annapolis Single Phase Railway.'

The following meeting will be held at the same place on Friday, Oct. 24, and a paper will be presented by Prof. Charles P. Matthews, of Lafayette, Ind., on "An Integrating Photometer for Glow Lamps and Sources of Like Intensity."

Traveling Engineers' Association.

The 10th annual convention was begun in Chicago Sept. 9. The programme includes the following subjects:

What qualifications should a man possess to fill the position of engine inspector?—J. C. McCullough.

Proper air-brake instructions to all concerned to prevent the ruin of wheels by skidding and the handling of air-brakes on freight trains.—Thomas Burton.

Best method of obtaining complete and intelligent reports of work needed on an engine to fit her for the next trip.—F. O. Miller.

Quickest and safest method of disconnecting the very heavy modern engines in case of breakdown.—G. W. O'Neal.

Best method of drafting locomotives, stack included, for all kinds of fuel.—D. Meadows.

"Oil Fuel Locomotives," by James McDonough.

"Handling Compound Locomotives to Obtain the Best Results," by W. J. McCarroll.

Rocky Mountain Railway Club.

The meeting on May 17 was the last of the season 1901-1902, and officers were elected for the ensuing year as follows: President, A. D. Parker, General Auditor Colorado & Southern Railway, Denver, Colo.; First Vice-President, T. A. Hedendahl, Western Representative Westinghouse Air-Brake Company, Denver; Second Vice-President, G. W. Rhodes, Assistant General Superintendent Burlington & Missouri Railroad, Lincoln, Neb.; Treasurer, J. W. Gilluly, Treasurer Denver & Rio Grande Railroad System, Denver; Fifth Member Executive Committee, W. J. Schlacks, Mechanical Engineer Colorado Midland Railway, Colorado City, Colo. There was no change made in the office of secretary, the present incumbent, K. E. Steinhauer, still retaining that position.

At this meeting there was discussion on "Petroleum as a Fuel," also "Do Lifting Injectors Receive Proper Attention?" Dr. Herman Von Schrenk, in charge of the Mississippi Valley Laboratory, United States Dept. of Agriculture, St. Louis, Mo., has submitted a paper to the club on the "Preservation of Timber," which is published in the May Proceedings. The next meeting is Sept. 15.

PERSONAL.

—Colonel Yorke, chief inspecting officer of the British Board of Trade (Railway Department), is expected to sail for the United States about the middle of September. He will be here only a few weeks. He comes for the purpose of looking into railroad matters on this side of the ocean.

—Colonel Frederick Martin, who for several years was General Manager of the Brooklyn Elevated Railroad, died suddenly Sept. 2, at Cranford N. J. Col. Martin was 68 years old and was a native of Philadelphia. He was a veteran of the Civil War, having enlisted in a New York regiment. Col. Martin resigned from the Brooklyn Elevated in May, 1892.

—Mr. W. F. Ackerman, who, on Sept. 1 last, became Master Mechanic of the Burlington & Missouri River Railroad in Nebraska, was born July 6, 1870, at Mt. Pleasant, Iowa. After receiving a common school education he entered the service of this company as an apprentice in the shop at Plattsmouth, Neb. He later became foreman, and in December, 1901, he was appointed general piece work inspector, from which position he has just been promoted.

—The new Superintendent of Motive Power of the New York, Chicago & St. Louis, Mr. Walter L. Gilmore, was formerly with the Lake Shore & Michigan Southern as a Master Mechanic. Mr. Gilmore was born at Boston, Mass., 54 years ago. He began his railroad service, as an apprentice on the Concord Railroad in 1864. In 1871 he went with the Lake Shore & Michigan Southern as a machinist. From 1881 to 1884 he was Master Mechanic of the Columbus, Cincinnati & Indianapolis, from which position he resigned to go with the Lake Shore & Michigan Southern in a similar capacity.

—Mr. E. Kennerdell, who recently succeeded Mr. J. A. Graham as Master Mechanic of the Baltimore & Ohio at Lorain, was born in Clarion County, Pa., May 26, 1852. He was educated at Emlenton Academy and

also took a business course at Duff's College, Pittsburgh. For seven years he was with Porter, Bell & Company, of Pittsburgh, and from there he went to Foxbury, Pa., as a Master Mechanic of the Pittsburgh, Bradford & Buffalo. This road was later absorbed by the Pittsburgh & Western. Mr. Kennerdell remained there until February, 1900, when he went to Cleveland as General Foreman of the Valley Railroad, the title of Master Mechanic of this road having been abolished and was transferred to his new position Sept. 1 last.

—Mr. Alexander Kearney, whose appointment as Superintendent of Motive Power of the Baltimore & Ohio took effect September first, commenced his railroad career as a special apprentice in the Pennsylvania shops at Altoona. He was afterwards appointed Road Foreman of Engines on the Philadelphia Division, and later filled the position of Assistant Engineer of Motive Power on the Philadelphia, Wilmington & Baltimore. In August, 1895, he became Assistant Engineer of Motive Power of the United Railroad of New Jersey. Four years later he was appointed Assistant General Superintendent of Motive Power, and in May, 1900, became Master Mechanic of the West Philadelphia shop, and in August, same year, became Superintendent of Motive Power of the Philadelphia, Wilmington & Baltimore, which position he retained until his new appointment as above.

—Mr. M. T. Carson, formerly Superintendent of Motive Power and Car Equipment of the Mobile & Ohio, died suddenly in St. Louis. Mr. Carson was born in 1844 at Seneca Castle, N. Y., and entered railroad service in 1859 on the Louisville, New Albany & Chicago. From then until 1875 Mr. Carson was engaged in different capacities on various roads. For one year (1875-1876) he was Master Mechanic of the Mississippi Division of the Mobile & Ohio, and in March, 1876, was transferred to the Northern Division, and remained on this division until 1883, when he became Master Mechanic of the entire line, with headquarters at Whistler. He resigned from this position in 1887 to go with the Gulf, Colorado & Santa Fe in a similar capacity, but returned to the Mobile & Ohio the following year as Superintendent of Machinery, and assumed the Superintendency of Motive Power and Car Equipment in May, 1899.

ELECTIONS AND APPOINTMENTS.

Algoma Central & Hudson Bay.—T. C. Search has been elected Treasurer, succeeding F. S. Lewis.

Arkansas & Choctaw.—The headquarters of C. M. Boswell, Superintendent, have been removed from Texarkana, Texas, to Hugo, Ind. T.

Canadian Pacific.—Superintendent R. Peard, of Brandon, has been appointed Superintendent of a new division to be called District No. 21, with headquarters at Souris. J. G. Taylor has been appointed Acting Superintendent at Brandon, succeeding Mr. Peard.

Central of New Jersey.—J. McGie, Division Master Mechanic, with headquarters at Jersey City, N. J., has resigned. (See Choctaw, Oklahoma & Gulf.)

Chicago & Southeastern (Cleveland, Cincinnati, Chicago & St. Louis).—The officers of this company are: President, John T. Dye, of Indianapolis; Treasurer, F. O. Comstock, of Cincinnati; Secretary, Charles R. Myers, of Cincinnati, and General Superintendent, W. S. Moore, of Galion, Ohio. (See R. R. News column.)

Chicago, Lake Shore & Eastern.—W. B. Causey has been appointed Chief Engineer in charge of Maintenance of Way and Bridges and Buildings of this company and the Elgin, Joliet & Eastern, with headquarters at Joliet, Ill., succeeding J. F. Cassell, resigned.

Choctaw, Oklahoma & Gulf.—J. McGie has been appointed Master Mechanic, with headquarters at Shawnee, Okla. T., succeeding J. Cunningham, resigned.

J. R. Poole becomes Superintendent of Bridges and Buildings.

C. J. Hogue has been appointed Assistant Engineer Maintenance of Way, with headquarters at Little Rock.

Elgin, Joliet & Eastern.—See Chicago, Lake Shore & Eastern.

Erie.—A. J. Stone has been appointed Assistant to the General Manager.

Fremont, Elkhorn & Missouri Valley.—Archibald A. Schenck, heretofore Division Engineer of the Chicago & North Western, has been appointed Chief Engineer of the F., E. & M. V., succeeding F. M. Marsh.

Illinois Central.—C. N. Bell has been appointed Division Superintendent of the Yazoo & Mississippi Valley, with headquarters at Vicksburg, Miss., succeeding A. J. Greif, resigned.

Illinois Southern.—A. F. Williams has been elected Treasurer, succeeding J. C. Jacobs, resigned.

Jacksonville & St. Louis.—H. A. Gardner has been elected President and H. W. Weiss, Secretary. Both with headquarters at Chicago, Ill.

Kansas City, St. Joseph & Council Bluffs.—W. Hurst has been appointed Superintendent of Bridges and Buildings, with headquarters at St. Joseph, Mo., succeeding M. P. Meyers, resigned.

Lake Shore & Michigan Southern.—H. E. Smith, heretofore Chemist of the Chicago, Milwaukee & St. Paul, has been appointed Chemist and Engineer of Tests of the L. S. & M. S., with headquarters at Collinwood, Ohio.

Licking River.—The headquarters of E. W. Strack, General Manager and Treasurer, have been removed from Ashland, Ky., to Yale, Ky.

Little Rock & Hot Springs Western.—G. L. Morris has been appointed General Superintendent and Auditor, with headquarters at Hot Springs, Ark., succeeding H. E. Martin.

Manitou & Pike's Peak.—C. W. Sells, General Manager, has been elected President, also.

New York Central & Hudson River.—W. O. Thompson, heretofore General Locomotive Inspector, has been appointed Division Superintendent of Motive Power of the Rome, Watertown & Ogdensburg Division, with headquarters at Oswego, N. Y., succeeding P. T. Lonergan.

The jurisdiction of G. H. Haselton, Division Superintendent of Motive Power, at West Albany, has been extended over Frankfort Foundry.

Ohio & Little Kanawha (Baltimore & Ohio).—At the annual meeting held Sept. 9, L. F. Loree, President of the B. & O., was elected President of the O. & L. K.

Pennsylvania.—N. M. Loney has been appointed Assistant Master Mechanic.

Peoria & Eastern (C., C., C. & St. L.).—M. D. Schaff has been appointed Superintendent, succeeding C. A. Paquette, transferred to the C., C., C. & St. L.

Philadelphia, Wilmington & Baltimore.—A. W. Gibbs has been appointed Superintendent of Motive Power, with headquarters at Philadelphia, Pa., succeeding A. Kearney, resigned.

St. Louis & Gulf.—J. F. Elder has been elected Vice-President, succeeding Jas. H. Allen, resigned. Mr. Elder has been appointed General Manager, effective Sept. 8. Louis Houck, President, has resigned.

St. Louis & North Arkansas.—W. S. Lawless has been appointed Master Mechanic, with headquarters at Eureka Springs, Ark., succeeding Joseph Orr, resigned.

Southern Pacific.—E. A. Gilbert has been appointed Master Car Builder of the Pacific System and Lines in Oregon, with headquarters at San Francisco, succeeding Benj. Welch, resigned.

Susquehanna, Bloomsburg & Berwick (Central Pennsylvania & Western).—The officers of this company are: J. Henry Cochran, President, with office at Williamsport, Pa.; S. B. Haupt, General Manager; Chas. Cochran, Secretary, Treasurer and Assistant General Manager, and M. A. Berger, Freight and Passenger Agent, all with headquarters at Watsontown, Pa. (See R. R. Construction column, Sept. 5, p. 696.)

Terminal R. R. Association of St. Louis.—T. N. Gilmore has been appointed Master Mechanic, succeeding W. C. Wilson, assigned to other duties.

Vandalia Line.—W. H. Coleman, heretofore Assistant General Freight Agent, has been appointed General Freight Agent, succeeding N. W. Taylor, who has become General Western Freight Agent, with headquarters at St. Louis, Mo.

Vera Cruz & Pacific.—F. M. Ames, heretofore Assistant Chief Engineer, has been appointed Chief Engineer, with headquarters at Orizaba, succeeding W. O. Titus, resigned.

Edward H. Mason has been appointed Secretary to the President, with headquarters at Mexico, succeeding Herbert Compton, resigned.

Yazoo & Mississippi Valley.—See Illinois Central.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ALPENA & WEST MICHIGAN.—A company with this name is being organized, it is said, to build a railroad about 90 miles long from Alpena to Charlevoix, Mich., across the peninsula. R. R. Metheany, Grand Rapids, Mich., may be addressed.

ATLANTIC, VILLISCA & GRANT (ELECTRIC).—This company was organized in Iowa Sept. 3 to build an electric line from Atlantic by way of Grant to Villisca, Iowa, 36 miles. Terminals and branch lines are also to be built. E. C. Pinkney, of Atlantic, Iowa, is President.

BUFFALO & SUSQUEHANNA.—It is announced that an extension will be built from Wellsville, N. Y., to Buffalo, 80 miles, by a corporation organized for the purpose. A tract of about 50 acres in Buffalo adjoining the new plant of the Lackawanna Steel Co. is said to have been acquired for terminal purposes. The Buffalo & Susquehanna was formerly the Sinnemahoning Valley. M. E. Olmstead, Buffalo, N. Y., is President.

CANADIAN PACIFIC.—The annual report, just issued, makes reference to the following building work in progress and planned for the near future. An agreement has been made to extend the Montreal & Western, a subsidiary line, in Quebec, 22 miles; a branch line 105 miles long from Kirkella, on the main line west of Brandon, to serve the country north of the Qu'Appelle River, is building; also an extension of the Manitoba & Northwestern, 40 miles long, and it is expected that these lines will be completed before winter. General improvement work includes the letting of 480 miles of 80-lb. rails on the main line, and before the end of 1904 it is hoped to have all the light rails replaced on the main lines of the system. Change of line during the year has also been made between Field and Ottertail, on the Pacific Division, seven miles, and a tunnel 894 ft. long has been built at the Loop on the Crows Nest Line to improve gradients and alignment. Other work done includes building of two steel grain elevators, with an aggregate capacity of 3,700,000 bu., at Fort William. Work on these is now in progress.

CANE BELT.—Surveys are reported from Lane City, Texas, by way of Dawson to Thompson's, on the line of the Gulf, Colorado & Santa Fe, a distance of about 4½ miles, and it is said that the line will be built soon. (May 30, p. 403.)

CENTRAL ILLINOIS.—This company has been incorporated in Illinois to build a railroad from Springfield to Decatur, a distance of about 40 miles direct. The names of interested parties are not stated.

CHARLESTON, PARKERSBURG & WESTERN.—A meeting for organization of this company, incorporated last June to build between Charleston and Parkersburg, W. Va., 65 miles, was held at Charleston Sept. 8. E. B. Neal, of Charleston, W. Va., may be addressed. (June 6, p. 421.)

CHESAPEAKE & OHIO.—Right of way is reported secured between Whitehouse and Paintsville, Ky., 10 miles, and application has been made to the War Department for permission to build a bridge across the Big Sandy at the foot of Buffalo shoals.

The Secretary of State of West Virginia has issued a certificate of extension to the Deepwater R. R. in the interest of the above, to build from the present terminus at Glen Jean, W. Va., through the Counties of Fayette, Raleigh, Wyoming, Mercer, Summers and Monroe to a point on the State line at Craig, Allegheny or Giles County, Va. Such a line would be from 60 to 70 miles long. At a special meeting of stockholders held at Arnsted, W. Va., Sept. 2, it was voted to build this extension.

CHICAGO & NORTH WESTERN.—It is said that a branch two miles long is to be built from the Platteville & Galena line in Illinois, to reach lead and zinc mines.

CHICAGO GREAT WESTERN.—It is said that the projected line from Fort Dodge, Iowa, to Omaha is under contract to be completed by Nov. 10. Grading is reported to be in progress and track laying is about to begin.

CHICAGO, ROCK ISLAND & PACIFIC.—The amount of building actually in progress at the present time is not great and consists of finishing up some lines in Oklahoma west of and parallel with the main line; the building of a branch from Chickasha, in the direction of Paul's Valley, Ind. T., 25 miles, to connect with a line built west from Paul's Valley by the Santa Fe; an extension of the Chicago, Rock Island & Texas from Jacksboro to Graham, Texas; the building of some short coal branches in connection with the Choctaw, Oklahoma & Gulf, and also a line from Guthrie 50 miles east, and the completion of the St. Louis, Kansas City & Colorado line between the present terminus at Belle and Versailles, Mo., 73 miles. The line between Versailles and Kansas City has been located, and within the next few weeks location will be completed also between Fort Worth and Houston, Texas. Location is now in progress between Amarillo, Texas, and Tucumcari, N. Mex., and location has been made from Wilburton, on the Ardmore branch of the Choctaw, Oklahoma & Gulf, to Dallas, Texas. Various surveys are also being made in other parts of the country, but actual work has not begun on any of these lines, and it is uncertain at the present time when it will begin.

CINCINNATI, LEBANON & NORTHERN.—Contract for double-tracking this line, which is operated in the interest of the Pennsylvania, and is 35 miles long, running between Cincinnati and Lebanon, Ohio, has been let to Edward Ryan, of Springfield, Ohio. The new rails will be of 70-lb. weight.

CLALLAM BAY & SOUTHERN.—Most recent advices concerning this road incorporated in Washington, name D. E. Fredericks, D. A. Robinson and S. M. Irwin as the incorporators. The principal place of business will be at Seattle. (Aug. 22, p. 664.)

CLEVELAND, ELYRIA & WESTERN (ELECTRIC).—It is said that an extension will be built next year from Wellington south toward Ashland, Ohio. The company now has about 100 miles of electric line in operation from Cleveland to Berea, Elyria and Oberlin, with branches. (July 18, p. 579.)

COPPER RANGE.—According to most recent reports, rights of way for this new line between Houghton and Calumet, Mich., 15 miles, have now been entirely secured, with the exception of two small tracts against which condemnation proceedings have been begun, and building is progressing favorably. Contract was let last May to C. J. Johnson. It is thought that the line will be completed and in operation by December.

DALLAS & YAQUINA.—This company has been incorporated in Oregon to build from Dallas to Yaquina Bay, a distance of about 42 miles in a southwesterly direction. J. C. Talbot, Dallas, Ore., may be addressed.

DE QUEEN & EASTERN.—This road, which is an extension of the Kansas City Southern, was opened Sept. 2 from De Queen, Ark., to Lockesburg, the seat of Sevier County, Kan. The company was incorporated in September, 1900, and will build as far as Murfreesboro on the Arkansas Southwestern. Lockesburg is 19 miles from De Queen.

EAU CLAIRE, CHIPPEWA FALLS & NORTHEASTERN (CHICAGO, ST. PAUL, MINNEAPOLIS & OMAHA).—An extension is to be built from Chippewa Falls to a connection with the Wisconsin Central by way of Anson, Hannibal and other towns, a distance of 67½ miles. About 28 miles of the distance will probably be in operation this fall. The general contract is let to Winston Bros., of Minneapolis. (July 4, p. 543.)

GRAND TRUNK.—Work is reported practically completed on the important changes which have been made on the main line east of Toronto, and in particular between Port Union and Oshawa, 33 miles from Toronto. The work has consisted in straightening curves, reducing grades and double tracking, and will be continued to Port Hope, 46 miles from Port Union.

GREAT NORTHERN.—It is said that no contracts will be let in connection with the new union station at Seattle, Wash., nor with the building of the tunnel underneath the city, but that the work will be done under the direction of the Engineering Department. For illustration of tunnel route, see under Seattle & Montana in our issue of Aug. 1.

IOWA & ST. LOUIS.—Contract is reported let to Wm. Kenefick to build about 30 miles of the projected line from the Missouri State line at a point 18 miles southwest of Centerville, Iowa, to Melrose, on the Chicago, Burlington & Quincy in the western part of Monroe County. The contract provides that the section shall be open for traffic by Jan. 1, 1903. It will connect at the State line with a stretch of 40 miles of track recently completed which reaches Missouri coal fields. The Iowa & St. Louis, in which John W. Gates is largely interested, is now operated on an irregular schedule between Centerville and Ninevah, Iowa, 38 miles, and is building to Macon, 45 miles beyond. H. F. Reddig, Guardian Trust Bldg., Kansas City, is President. (May 23, p. 386).

KANSAS CITY, BENTONVILLE & SOUTHEASTERN.—Articles of incorporation were filed in Arkansas Aug. 27 for a line to be operated by either steam or electricity from Bentonville, in Benton County, in a northeasterly direction, following the general course of Sugar Creek to the Missouri line, and thence in a westerly direction to the town of Rutledge, McDonald County, Mo., a total distance of about 35 miles. The incorporators are A. M. Campbell, Chas. Haney and others, of Bentonville, Ark.

KENNETT-OXFORD (ELECTRIC).—Work was begun Aug. 19 on this new electric line in Pennsylvania between the points named, a distance of 15 miles, paralleling the Philadelphia, Wilmington & Baltimore.

KENT & CECIL LIGHT, POWER & RAILWAY.—Franchise was granted this company Aug. 20, to build an electric line over the public roads in Cecil County from the Delaware State line near Iron Hill, to Chesapeake City and Fredericktown, Md., by way of Elkton, a distance of about 20 miles. Edwin R. Cochran, Jr., Wilmington, Del., is President. The franchise was opposed by the Cherry Hill, Elkton & Chesapeake City Co., which was granted a similar franchise some time ago.

KNIGHTSTOWN-DUBLIN (ELECTRIC).—Contract for this projected line in Indiana has been let to the Kirkpatrick Construction Co. The distance is about 18 miles, paralleling the Pittsburgh, Cincinnati, Chicago & St. Louis, and it is said that it will be in operation before Christmas.

LAKE ERIE TERMINAL.—An officer writes in regard to this new company, chartered Aug. 15 to build from a point on Lake Erie at or near the mouth of Elk Creek to Albion, Pa., 11 miles, that surveys are at present being made, but location has not yet been definitely decided on, and it is not known when contracts are likely to be let. Edwin S. Templeton, of Greenville, Pa., is President.

MISSOURI PACIFIC.—Rights of way are reported being secured for the Memphis, Helena & Louisiana branch, which is to run in Arkansas through the Counties of Lee, Phillips and Desha, a distance of 135 miles.

NASHVILLE & MCMINNVILLE.—It is said that work will begin soon on this new line to be built between the points named in Tennessee, with the prospect of ultimate extension to Chattanooga. The route between Nashville and McMinnville will be about 73 miles long.

NEW ORLEANS & MONTICELLO.—Charter for incorporation of this new line in Louisiana was filed at New Orleans Aug. 29. It provides for a road from Monticello to run through the parishes of Washington, Tangipahoe, Livingston and others to a connection with the Illinois Central, and Hunter C. Leak, O. M. Dunn and others interested in the Illinois Central are among the incorporators. It is said that work will be begun as soon as the necessary surveys can be made.

NORTH SHORE.—Work is reported in progress converting this line in California from narrow gage to standard gage. The line extends from San Francisco to Cazadero, Cal., 86 miles, including a ferry six miles long, and is now operated by steam, but electrical equipment is to be established and in running order by the first of next March. (June 13, p. 454).

OKLAHOMA & WESTERN.—According to most recent advices, this new line to extend from Oklahoma City, Okla. T., to Acme, Texas, 200 miles, has been completed as far as Lawton, Okla. T., 100 miles from the starting point, and trains are to be put in operation between these two points at once. The company was organized in December, 1900. James Campbell and F. J. Wade, of St. Louis; D. C. Lewis, of Oklahoma City, and others, are among the directors.

OTTAWA, BROCKVILLE & ST. LAWRENCE.—This company was organized at Ottawa on Aug. 26 to connect Ottawa with the Grand Trunk at Brockville, Ont., a distance of about 58 miles in a southerly and southwestern direction, practically paralleling the Canadian Pacific, although the latter makes connection with the Grand Trunk further east. J. Carling Kelly, of Ottawa, is President. It is said that considerable English capital is interested.

PINE BLUFF & WESTERN.—At a meeting of the stockholders Sept. 7, an extension of the main line and building of additional branches was authorized. It was also voted to issue bonds. W. W. Cargill, Pine Bluff, Ark., is President.

POCAHONTAS, COAL RIVER & KANAWHA.—An officer is quoted as saying that the company has at present 13 miles of road under contract in West Virginia. Grading is being done by Reynolds & Sterling.

PORTLAND-SPRINGWATER (ELECTRIC).—It is said that contract has been let for the first 5½ miles of this projected line in Oregon and that work will begin at once. The total distance will be about 30 miles, and the remainder of the distance will be let in about a month.

PRINCESS ANNE & DEAL'S ISLAND LIGHT, POWER & RAILROAD.—Organization has been effected in Maryland of a company to build an electric line between Princess Anne and Deal's Island, a distance of about 20 miles. Hampden P. Dashiell is President, and may be addressed at Princess Anne, Md.

QUEEN & CRESCENT.—Contract has been let to Geo. W. Callahan, of Knoxville, Tenn., to double track the line between Harriman and Somerset, Ky., a distance of about 98 miles.

ST. LOUIS & NORTH ARKANSAS.—According to most recent advices the Little Rock extension is now practically completed as far as St. Joe, Ark., 22 miles, direct, from the present terminus of the line at Harrison, Ark. The route as surveyed runs from St. Joe by way of Leslie, Quitman and Conway, a total of 130 miles, air line distance, from Harrison to Little Rock, and it is thought that work will be completed as far as the south line of Searcy County, 15 miles beyond St. Joe, by the middle of November. The St. Louis & North Arkansas is in operation from Seligman, Mo., on the line of the St. Louis & San Francisco to Harrison, Ark., 66 miles.

ST. LOUIS & SAN FRANCISCO.—Contract is reported let to Johnson Bros., of Peoria, Ill., to build an extension from Enid, Okla. T., to Tulsa, a distance of about 125 miles. Rights of way are reported secured.

SALEM, FALLS CITY & WESTERN.—An officer is quoted as saying that building will be proceeded with on this projected line in Oregon. The route, as originally outlined, was to run from Salem, in Marion County, to the mouth of the Siletz River in Lincoln County, a distance of about 75 miles, but it is planned for the present to build only between Dallas and Falls City in Polk County, nine miles. Connection with the Southern Pacific will be established at Dallas, and there are sawmills at the other end of the line. Surveys were made in July. Louis Gerlinger, of Portland, Ore., is President.

SEABOARD AIR LINE.—An officer writes that surveys are practically completed for the 10-mile section between Coal City and Birmingham, Ala., and that contracts for grading, track laying, etc., will be let at once. The work to be done is very heavy. Maximum grade, 1 per cent.; maximum curvature, 6 deg. There will be eight steel trestles and two tunnels on the line. J. W. Bushnell, Portsmouth, Va., is engineer in charge of construction. (Aug. 22, p. 664.)

SOUTHERN PACIFIC.—Work is reported begun on the new line in Arizona from Cochise, on the main line of the Southern Pacific, through Pearce, 16 miles, to Sulphur Springs Valley and Naco, where a connection is to be made with the Green Consolidated road now in operation between Naco and Cananea. It is proposed to eventually extend this line to some point on the western coast of Mexico. (Aug. 22, p. 664.)

SPRINGFIELD & CENTRAL ILLINOIS ELECTRIC.—Articles of incorporation for this company were filed at Springfield, Ill., Sept. 2. They provide for four electric lines running from Springfield; one in a northeasterly direction, through the Counties of Sangamon, Logan and McLean to Bloomington; one through the Counties of Sangamon and Macon to Decatur in an easterly direction, and also south from Springfield to Carlinville, and west from Springfield to Jacksonville, Ill., a total of about 170 miles. It is said that rights of way purchased some time ago by the Everett-Moore Syndicate will be used for a portion of the distance. The incorporators are St. John Boyle and Wm. Jarvis, of Louisville, Ky.; Colonel C. K. Minary, of Springfield, and others.

SPRING GARDEN-FROG MOUNTAIN.—Contract has been let to the Alabama Construction Co. of Anniston, to grade 4½ miles of road between these points. The line is designed to carry iron ore, and it is said that it will be completed in six weeks. The names of interested parties are not stated.

SUSQUEHANNA & NEW YORK.—An officer writes in regard to the proposed extension of the company's lines, that the terminals of the new road will be at Binghamton, N. Y., and Waterville, Pa. The line will run by way of Towanda and Ralston, and of this distance 20 miles is now completed from Towanda to a point four miles west of Barclay, Pa. Location surveys have been completed for the line west from that point to Ralston, and contracts for grading have been let and the work has been begun on two sections of 12 miles each. The contractors working at present are Whalen Bros., of Towanda, and Coryell & Dunbar, of Williamsport, Pa. About 500 men are at work at the present time. Maximum grade, about 1½ per cent.; maximum curvature, about 12 deg. The work involves one 300-ft. bridge of two spans, one 160-ft. two-span bridge, and one 110-ft. single span. Several concrete arches have been built or contracted for, and there will be several trestles, one of which is 300 ft. long and 80 ft. high. Rails and rolling stock have been secured, and to cover cost of new building, etc., an issue of $2,000,000 bonds has been authorized. The line is now in operation between Towanda and Foot of Plane, Pa., 14 miles, making connection with the Lehigh Valley at Towanda. C. S. Horton, Williamsport, Pa., is General Manager.

TENNESSEE, GEORGIA & SOUTH CAROLINA.—Application for a charter for this company has been made to build from Walhalla, S. C., across the northern part of Georgia, and to Charleston, Tenn., a total distance of about 100 miles direct. The incorporators are Wm. B. Frink and others, of Chicago; Merrill Skinner, Blue Ridge, Ga.; C. G. Baugh, Mineral Bluff, Ga., and others.

TENNESSEE ROADS.—Surveys are reported to open up phosphate tracts in the vicinity of Ashwood, Tenn. W. B. Southgate, of Nashville, Tenn., is the engineer in charge.

UTAH WESTERN.—Articles of incorporation were filed at Portland, Ore., Aug. 31, with the object of building railroad, telegraph and telephone lines, etc., within the State of Utah. The eastern terminus of the main line is to be at Salt Lake City, and the western terminus will be at some point on the western boundary line of Utah. John K. Kollock, of Portland, is one of the incorporators.

VELASCO, BRAZOS & NORTHERN.—It is said that an extension from Anchor, Texas, to a point in Grimes County will be completed shortly, and that an amendment is to be filed to the company's charter within a few days providing for other extensions. C. C. Waller, Houston, Texas, is President.

VIESCA-MAZAPIL.—A concession for a railroad between these points in the State of Coahuila through the Laguna country, about 83 miles, has been granted to Claude Martinez & Son, the owners of the Hornos ranch and railroad. The road will be narrow gage and laid with 30-lb. rail.

VIRGINIA-CAROLINA.—Work is reported in progress on an extension to Laurel Creek, Va., and preliminary surveys for an extension to White Top have been completed. It is expected to begin work on the latter next spring. The line is at present in operation between Abingdon, where connection is made with the Norfolk & Western, and Crandull, a distance of 26 miles. W. E. Mingea, Abingdon, Va., is President and General Manager.

YORK TRACTION.—A survey is to be made this winter of extensions from York, Pa., to Hanover, 18 miles, and from York to Wrightsville, 10 miles. It is expected that these lines will be built early in the spring. The company now operates about 45 miles of electric road in Pennsylvania.

GENERAL RAILROAD NEWS.

CANANEA, YAQUI RIVER & PACIFIC.—A circular was issued some little time ago stating that the Cananea Consolidated Copper Company's standard gage line between La Cananea, in Sonora, Mexico and Naco in the same State, had been acquired and that control was assumed over the same. The Cananea, Yaqui River & Pacific was organized in Arizona early in the summer with the purpose of building about 600 miles of railroad in Mexico. Epes Randolph is President and General Manager. The Cananea Consolidated Copper Company's line was reported opened last April and is 42 miles long.

CHICAGO & SOUTHEASTERN.—John T. Dye, the new President, is quoted as saying that the parties represented by him have purchased the bonds under the general mortgage of the Chicago & Southeastern, and have become the owners of all the stock, but have not assumed the debts created under the Crawford management, and that these will be paid by the people who created them. Mr. Dye is General Counsel of the Cleveland, Cincinnati, Chicago & St. Louis, but the Chicago & Southeastern will not become a part of this system, but will be operated independently and will be owned and controlled by its own stockholders. It extends from Muncie to Brazil, Ind., 127 miles, and is now in the hands of a receiver for the discharge of whom an order has been entered. It was seized by Receiver Benjamin Simpson on Aug. 24, who acted on published reports that the line had been sold by its former President.

CHICAGO, INDIANAPOLIS & LOUISVILLE.—On and after Sept. 2 holders of J. P. Morgan & Company's trust certificates for preferred and common stock, deposited under the circular of the Louisville & Nashville and of the Southern, dated May 20, 1902, are entitled to receive the new bonds or the cash upon presentation and surrender of their trust receipts. Notice to this effect is signed jointly by the Louisville & Nashville and the Southern through J. P. Morgan & Co., depositaries.

CHICAGO, ROCK ISLAND & PACIFIC.—Additional capital stock to the amount of $880,500 has been listed by the Stock Exchange, and the issue of further amounts until Oct. 15, 1902, making a total not to exceed $75,000,000, has been authorized. An increase in the capital stock of the Chicago, Rock Island & El Paso to $4,000,000 has been filed at Santa Fe, and a mortgage made to secure bonds to be issued at the rate of $25,000 per mile of single track, $800 additional per mile for equipment, and $15,000 per mile for second track. The Chicago, Rock Island & Pacific R. R. Co. (Iowa) gives notice under date of Sept. 1, that the time within which outstanding stock of the Chicago, Rock Island & Pacific Ry. will be purchased under date of the July 31 offer, has been extended until Sept. 20.

Official confirmation that over 90 per cent. of the shareholders have deposited their holdings in favor of the financial readjustment plan, is reported. There has been much criticism of the clauses authorizing directors of the corporation to "deal" in the company's shares, to buy the stock and decrease outstanding capitalization, and to reissue and sell the same, making a flexible capital, giving to the directors power to perform functions ordinarily reserved to full meetings of stockholders. In consideration of this, although the flexible capital is pointed out to be merely a duplication of provisions in a number of prominent New Jersey incorporations, the officers of the company are quoted as saying that the objectionable provision will be eliminated entirely.

FINDLAY, FORT WAYNE & WESTERN.—Application has been made in the United States Court at Toledo, Ohio, for the appointment of a receiver of this property, recently purchased by the Cincinnati, Hamilton & Dayton. The road is 79 miles long, running between Findlay, Ohio, and Fort Wayne, Ind., and issued $1,200,000 5 per cent. bonds in November, 1894, which were secured by mortgage and a deed of trust made to the Mercantile Trust Co. Interest has been defaulted since July, 1895, and $450,000 is now said to be due.

GRAND TRUNK.—Purchase of the Detroit & Toledo Shore Line by this company is reported. This was one of the Everett-Moore traction properties operating 40 miles of double-track rock-ballasted road between Trenton, Mich., 20 miles south of Detroit, and Toledo, on a private right of way, with 80-lb. rails, heavy bridges and permanent stone arch culverts. It has an outstanding indebtedness of about $1,500,000.

ILLINOIS CENTRAL.—In regard to the recent increase of capital stock from $79,200,000 to $95,040,000, President Fish is quoted as saying that the proceeds are to be applied to general improvements. Of these about $250,000 will go into the new office building which is being erected beside the Chicago station. A large sea wall is also to be built along the lake front at Chicago. No additions to the system are contemplated except some short spurs in Mississippi, but double-tracking the entire line between Chicago and New Orleans will be completed and other improvements will be carried out. (Sept. 5, p. 696.)

MANHATTAN RAILWAY.—The Manhattan has at last come within sight of the maximum traffic reached in 1893. That year it carried 221,407,197 passengers, and earned gross $11,086,360. The business then fell off to the minimum in 1899 of 174,324,575 passengers and $8,719,496 gross earnings. In the year to June 30, 1902, the passengers carried were 215,259,345, and the gross earnings $10,665,911. A comparison with 1901 appears in the table below:

	1902.	1901.
Gross earnings	$10,665,911	$9,416,888
Operating expenses	5,518,585	5,253,230
Net earnings	$5,147,326	$4,163,658
Other income	625,800	836,384
Total income	$5,773,126	$5,000,042
Taxes and interest	2,699,671	2,677,706
Net income	$3,073,455	$2,322,335
Dividends	1,920,000	1,920,000
Surplus	$1,153,455	$402,335

The net income is equal to about 6½ per cent. dividend on the stock. The number of passengers carried increased 25,213,604.

MARIETTA, COLUMBUS & CLEVELAND.—It is said that this road, which runs from Moore's Junction to Palos, Ohio, 41 miles, with branches bringing the total to 49 miles, has been sold to the Little Kanawha in the Gould interests, in connection with the project to establish a new coal route into the West Virginia coal fields.

NEW YORK-CANADIAN PACIFIC.—A company with this name has asked authority from the State Railroad Commissioners to issue a $25,000,000 mortgage for purposes of building their projected line between New York and Canada. It is opposed by the New York Central & Hudson River on the ground that the alleged consolidation is composed of a number of franchises which have gone out of existence. L. H. Boyce, Verplanck Colvin and others are interested in the New York-Canadian Pacific project, and claim that the company is now in position to build. A number of old franchises, on none of which any actual progress has been made, compose the consolidation.

OKLAHOMA & TEXAS SOUTHERN.—A meeting of stockholders will be held on Sept. 22 to apply for authority to issue mortgage bonds on the proposed line from a point on the Red River near Spanish Fort, Montague County, Texas, southwest by way of Weatherford to Stephensville, a distance of 125 miles. It is said that $2,000,000 will be applied for.

PITTSBURGH TERMINALS, RAILROAD & COAL.—It is said that this company, incorporated in Pennsylvania last April with a nominal capital stock which the stockholders voted to increase last June to $14,000,000, has purchased a controlling interest in the stock and bonds of the West Side Belt, and also a large tract of coal land in Allegheny County. The West Side Belt is to be double-tracked and will operate in all about 30 miles of track connecting with the works of the Crucible Steel Co., and to the coal fields of the Clairton Steel Co. Chas. Donnelly is President, and is also a director of the West Side Belt.

SOUTHERN.—The New York Stock Exchange has been asked to list $1,500,000 first consolidated mortgage 5's. These bonds were issued to the company about two years ago to provide for additions and improvements and make a total of $36,775,000.

TEXAS SOUTHERN.—Application has been made to the Texas Railroad Commission to issue $750,000 of bonds on 72 miles of completed track between Marshall and Winnsboro, Texas. A similar request to issue $1,296,000 bonds on the same stretch of line was made last March.